TABLES

TABLE ES-1
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	COSTS		
							Capital Costs	Annual O&M Costs	Present Worth
SURFACE SOIL (SS)									
Alternative SS-1: No Action	□	□	□	□	■	■	$0	$0	$0
Alternative SS-2: Institutional Controls	◘	■	◘	□	■	■	$185,000	$30,000	$600,000
Alternative SS-3: Permeable Cover with Institutional Controls	■	■	◘	□	◘	◘	$5,329,000	$48,000	$5,992,000
Alternative SS-4: Excavation and Off-Site Disposal	■	■	■	□	◘	■	$47,172,000	$0	$47,172,000
Alternative SS-5: Excavation, Treatment, and On-Site Reuse	■	■	■	■	◘	◘	$22,993,000	$0	$22,993,000
SUBSURFACE SOIL (SUB)									
Alternative SUB-1: No Action	□	□	□	□	◘	■	$0	$0	$0
Alternative SUB-2: Institutional Controls	■	■	◘	□	■	■	$315,000	$108,000 (yr 1-10) $30,000 (yr 11-30)	$1,276,000
Alternative SUB-3: Permeable Cover with Institutional Controls	■	■	■	□	◘	◘	$6,495,000	$159,000 (yr 1-10) $81,000 (yr 11-30)	$8,070,000
GROUNDWATER (GW)									
Alternative GW-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	◘	■	◘	◘	◘	■	$432,000	$410,000 (yr 1-5) $205,500 (yr 6-30)	$3,918,000
Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	■	■	■	■	◘	◘	$4,739,000	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$19,137,000
Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment, and Monitoring with Institutional Controls	■	■	◘	◘	◘	□	$13,089,000	$444,000 (yr 1-5) $222,000 (yr 6-30)	$17,792,000
HBHA POND SEDIMENTS (HBHA)									
Alternative HBHA-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative HBHA-2: Monitoring	□	□	□	□	◘	■	$0	$144,000/yr 1-2 $70,000/yr 3-30	$1,201,000
Alternative HBHA-3: Subaqueous Cap	■	■	◘	□	◘	□	$3,160,000	$144,000	$5,291,000
Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat	■	◘	◘	◘	◘	◘	$5,419,000	$176,000/yr 1-3 $100,000/yr 4-30 $1,136,500 (every 5yrs)	$9,187,000
Alternative HBHA-5: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$3,560,000	$95,000/yr 1-3 only	$3,810,000
NEAR SHORE SEDIMENTS (NS)									
Alternative NS-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative NS-2: Institutional Controls	◘	◘	◘	□	■	■	$70,000	$16,300	$338,000
Alternative NS-3: Monitored Natural Recovery	◘	◘	◘	□	■	■	$70,000	$135,000	$1,807,000
Alternative NS-4: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$2,997,000	$95,000/yr 1-3 only	$3,247,000
DEEP SEDIMENTS (DS)									
Alternative DS-1: No Action	□	□	□	□	■	◘	$0	$0	$0
Alternative DS-2: Institutional Controls	◘	◘	◘	□	■	■	$44,000	$30,000	$459,000
Alternative DS-3: Removal and Off-Dite Disposal	■	■	■	◘	□	◘	$116,968,000	$100,000/yr 1-3 only	$117,378,000
SURFACE WATER (SW)									
Alternative SW-1: No Action	□	◘	□	□	■	◘	$0	$0	$0
Alternative SW-2: Monitoring	□	◘	◘	□	■	■	$0	$236,000	$3,226,000
Alternative SW-3: Monitoring and Providing an Alternate Habitat	◘	◘	■	□	■	◘	$7,807,000	$236,000	$10,797,000

□ **Low rating in comparison to other alternatives for specificed criterion**

◘ **Mid-range rating in comparison to other alternatives for specificed criterion**

■ **High rating in comparison to other alternatives for specificed criterion**

TABLE 1-1
SUMMARY OF HUMAN HEALTH RECEPTOR RISKS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Station	Scenario/Receptor (Recreational User)	RME or CT	Total Cancer Risks	Total Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
SEDIMENT						
13/TT-27	Future	RME	**7E-04**	**1E+01**	sediment	(C) - As; benzo(a)pyrene
		CT	5E-05	**3E+00**		(NC) - As
WH	Current	RME	1E-04	**2E+00**	sediment	(NC) - As
		CT	2E-05	1E+00		
	Future	RME	**4E-04**	**7E+00**	sediment	(C) - As; benzo(a)pyrene
		CT	2E-05	1E+00		(NC) - As
NT-3	Future	RME	9E-05	**2E+00**	sediment	(NC) - As
		CT	6E-06	4E-01		
CB-03	Current	RME	1E-04	**3E+00**	sediment	(C) - As
		CT	2E-05	1E+00		(NC) - As
	Future	RME	1E-04	**3E+00**	sediment	(NC) - As
		CT	2E-05	1E+00		
SEDIMENT CORES						
SC02	Future Dredger	RME	5E-05	**4E+00**	sediment	(NC) - As
		CT	6E-06	1E+00		
SC05	Future Dredger	RME	3E-05	**3E+00**	sediment	(NC) - As
		CT	5E-06	1E+00		
SC06	Future Dredger	RME	6E-05	**5E+00**	sediment	(NC) - As
		CT	7E-06	1E+00		
SC08	Future Dredger	RME	4E-05	**4E+00**	sediment	(NC) - As
		CT	3E-06	5E-01		
SOIL						
SO	Future Day Care Child (surface soil)	RME	1E-04	**2E+00**	soil	(C) - As
		CT	2E-05	1E+00		
	Future Day Care Child (subsurface soil)	RME	**1E-03**	**4E+01**	soil	(C) - As
		CT	**3E-04**	**2E+01**		(NC) - As
	Future Const. Worker (subsurface soil)	RME	4E-05	**7E+00**	soil	(NC) - As
		CT	1E-05	**2E+00**		
GROUNDWATER						
Northern Study Area	Future Const. Worker	RME	2E-05	**3E+00**	groundwater	(NC) - As
		CT	6E-06	9E-01		
	Future Industrial Worker	RME	**1E-03**	**2E+01**	groundwater indoor air	(C) - 1,2-Dichloroethane, benzene, chloroform, trichloroethene, MTBE, As
		CT	**4E-04**	**2E+01**		(NC) - Benzene, naphthalene, As
	Future Car Wash Worker	RME	**1E-03**	**2E+01**	indoor air	(C) - 1,2-Dichloroethane, benzene, chloroform, trichloroethene, MTBE
		CT	**4E-04**	**2E+01**		(NC) - Benzene, naphthalene

Notes:
Bolded values exceed a cancer risk of 1E-04 or a target organ HI of 1.

HI - Hazard Index
RME - Reasonable Maximum Exposure
CT - Central Tendency Exposure
As - Arsenic
(C) - Carcinogenic Risk
(NC) - Noncarcinogenic Risk

TABLE 1-2
SUMMARY OF RISK CONCLUSIONS - COMBINED STUDY AREAS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Receptor	Endpoint	INCREASING LEVEL OF RISK FROM NEGLIGIBLE TO HIGH → → → → → → →					Unacceptable Ecological Risk[1]
		Negligible Risk Potential Low Uncertainty	**Low Risk Potential Increased Uncertainty**	**Moderate Risk High Uncertatinty**	**Moderate/High Risk Decreased Uncertainty**	**High Level of Impacts Low Uncertainty**	
Muskrat	Sustainability (survival, growth, reproduction) of local populations of omnivorous, semi-aquatic mammals			Moderate risk - arsenic in diet in Reaches 0, 1 & 2. Modeling with high uncertainty. Uncertain population effects.			No
River Otter	Sustainability (survival, growth, reproduction) of local populations of piscivorus, semi-aquatic mammals		Low risk. Modeling with moderate uncertainty.				No
Green Heron	Sustainability (survival, growth, reproduction) of local populations of piscivorus birds	Negligible Risk Potential Low Uncertainty.					No
Mallard	Sustainability (survival, growth, reproduction) of local populations of waterfowl		Low risk due to metals in limited area of Reach 1. Modeling with moderate uncertainty.				No
Northern Short-tailed Shrew	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals		Low risk - arsenic in diet. Modeling with high uncertainty. Uncertain population effects.				No
Warmwater fish populations	Sustainability (survival, growth, reproduction) of local populations of bottom-feeding fish	Reaches 2 to 6 with low risk based on tissue data. Uncertain risk in Reach 1.	HBHA Pond and HBHA Wetlands with low risk based on tissue arsenic data. Some exceedences of tissue benchmarks. Uncertain population effects.				No
Benthic Invertebrate Communities	Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates		HBHA wetland and Reaches 1 & 2 with Low/uncertain toxicity and communtiy impairment.		HBHA Pond with high risk based on severe toxicity and community impairment. High tissue metals.		Yes

RATING: L = LOW, M = MODERATE, H = HIGH , U = UNCERTAIN , n / a = NEGLIGIBLE RISK, or not applicable

Note: 1 Unacceptable Risk is defined in USEPA (1999) as a predicted impact to a local population or community of sufficient magnitude, severity, areal extent, and duration that they will not be able to recover and/or maintain themselves in a healthy state. Additionally, these effects are predicted to exceed the natural variation in similar reference areas.

TABLE 1-3
SUMMARY OF RECEPTOR RISKS - SOIL
HUMAN HEALTH RISK ASSESSMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Station	Scenario/Receptor	RME or CT	Total Cancer Risks	Total Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
A6	Current Rec. User	RME	7E-06	2E-01		N/A
		CT	2E-06	1E-01		
	Future Rec. User	RME	1E-05	4E-01		N/A
	(surface soil)	CT	2E-06	1E-01		
	Future Rec. User	RME	2E-05	5E-01		N/A
	(subsurface soil)	CT	7E-07	6E-02		
HB04	Current Rec. User	RME	3E-07	1E-02		N/A
		CT	7E-08	6E-03		
	Future Rec. User	RME	7E-07	2E-02		N/A
	(surface soil)	CT	7E-08	6E-03		
	Current Groundskeeper	RME	2E-06	1E-02		N/A
	(surface soil)	CT	4E-07	7E-03		
	Future Groundskeeper	RME	7E-06	5E-02		N/A
	(surface soil)	CT	1E-06	2E-02		
	Future Day Care Child	RME	2E-05	6E-01		N/A
	(surface soil)	CT	4E-06	3E-01		
	Future Const. Worker	RME	6E-07	1E-01		N/A
	(surface soil)	CT	2E-07	3E-02		
SO	Current Groundskeeper	RME	1E-05	5E-02		N/A
	(surface soil)	CT	2E-06	2E-02		
	Current Day Care Child	RME	1E-04	1E+00		N/A
	(surface soil)	CT	1E-05	7E-01		
	Future Groundskeeper	RME	4E-05	2E-01		N/A
	(surface soil)	CT	6E-06	8E-02		
	Future Day Care Child	RME	1E-04	**2E+00**	soil	(C) - As
	(surface soil)	CT	2E-05	1E+00		
	Future Day Care Child	RME	**1E-03**	**4E+01**	soil	(C) - As
	(subsurface soil)	CT	**3E-04**	**2E+01**		(NC) - As
	Future Const. Worker	RME	3E-06	4E-01		N/A
	(surface soil)	CT	1E-06	1E-01		
	Future Const. Worker	RME	4E-05	**7E+00**	soil	(NC) - As
	(subsurface soil)	CT	1E-05	**2E+00**		
NR	Current	RME	2E-05	4E-01		N/A
	Recreational User	CT	4E-06	2E-01		
	Future	RME	4E-05	9E-01		N/A
	Recreational User	CT	4E-06	2E-01		
WSS	Current	RME	4E-06	2E-01		N/A
	Recreational User	CT	2E-06	1E-01		
	Future	RME	4E-06	2E-01		N/A
	Recreational User	CT	2E-06	1E-01		
CB-05	Current	RME	2E-05	6E-01		N/A
	Recreational User	CT	1E-05	5E-01		
	Future	RME	2E-05	6E-01		N/A
	Recreational User	CT	1E-05	5E-01		
DA	Current	RME	6E-05	2E+00 [(a)]		N/A
	Recreational User	CT	4E-06	3E-01		
	Future	RME	6E-05	2E+00 [(a)]		N/A
	Recreational User	CT	4E-06	3E-01		

TABLE 1-3 (cont.)
SUMMARY OF RECEPTOR RISKS - SOIL
HUMAN HEALTH RISK ASSESSMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Station	Scenario/Receptor	RME or CT	Total Cancer Risks	Total Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
KF	Current Recreational User	RME	1E-05	4E-01		N/A
		CT	9E-07	7E-02		
	Future Recreational User	RME	1E-05	4E-01		N/A
		CT	9E-07	7E-02		
DP	Current Recreational User	RME	1E-05	5E-01		N/A
		CT	9E-07	9E-02		
	Future Recreational User	RME	1E-05	5E-01		N/A
		CT	9E-07	9E-02		
AJRW	Current Recreational User	RME	2E-05	5E-01		N/A
		CT	1E-06	9E-02		
	Future Recreational User	RME	2E-05	5E-01		N/A
		CT	1E-06	9E-02		
WSS	Current/Future Area Resident	RME	1E-05	5E-01		N/A
		CT	8E-06	5E-01		
CB-05	Current/Future Area Resident	RME	7E-05	2E+00 [(a)]		N/A
		CT	5E-05	2E+00 [(a)]		
KF	Current/Future Area Resident	RME	5E-05	1E+00		N/A
		CT	9E-06	8E-01		
DP	Current/Future Area Resident	RME	5E-05	2E+00 [(a)]		N/A
		CT	9E-06	1E+00		
AJRW	Current/Future Area Resident	RME	7E-05	2E+00 [(a)]		N/A
		CT	1E-05	9E-01		

Notes:
Bolded values exceed a cancer risk of 1E-04 or a target organ HI of 1.
(a) Even though the total receptor HI exceeded 1 for this pathway, target organ HIs were all less than the target HI of 1.

HI - Hazard Index
RME - Reasonable Maximum Exposure
CT - Central Tendency Exposure
As - Arsenic
(C) - Carcinogenic Risk
(NC) - Noncarcinogenic Risk
NE - Not Evaluated
N/A - Not Applicable

TABLE 1-4
SUMMARY OF RECEPTOR RISKS - GROUNDWATER
HUMAN HEALTH RISK ASSESSMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Station	Scenario/Receptor	RME or CT	Total Cancer Risks	Total Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
Class A	Future Const. Worker	RME CT	4E-07 2E-08	1E-01 1E-02		N/A
	Future Industrial Worker	RME CT	1E-05 3E-06	2E-01 1E-01		N/A
	Future Car Wash Worker	RME CT	N/A N/A	2E-02 1E-02		N/A
Study Area	Future Const. Worker	RME CT	2E-05 6E-06	**3E+00** 9E-01	groundwater	(NC) - As
	Future Industrial Worker	RME	**1E-03**	**2E+01**	groundwater indoor air	(C) - 1,2-Dichloroethane, benzene, chloroform, trichloroethene, pentachlorophenol, MTBE, As
		CT	**4E-04**	**2E+01**		(NC) - Benzene, naphthalene, As
	Future Car Wash Worker	RME	**1E-03**	**2E+01**	indoor air	(C) - 1,2-Dichloroethane, benzene, chloroform, trichloroethene, MTBE
		CT	**4E-04**	**2E+01**		(NC) - Benzene, naphthalene

Notes:
Bolded values exceed a cancer risk of 1E-04 or a target organ HI of 1.

HI - Hazard Index
RME - Reasonable Maximum Exposure
CT - Central Tendency Exposure
As - Arsenic
MTBE - Methyl tert-butyl ether
(C) - Carcinogenic Risk
(NC) - Noncarcinogenic Risk
NE - Not Evaluated
N/A - Not Applicable

TABLE 1-5
SUMMARY OF RISK CONCLUSIONS - MSGRP RI STUDY AREA
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Receptor/ Endpoint	INCREASING LEVEL OF RISK FROM NEGLIGIBLE TO HIGH → → → → → → →					Ecological Significance [1]						Unacceptable Ecological Risk[15]
	Negligible Risk Potential Low Uncertainty	Low Risk Potential Increased Uncertainty	Moderate Risk High Uncertatinty	Moderate/High Risk Decreased Uncertainty	High Level of Impacts Low Uncertainty	Endangered or sensitive species[2]	Magnitude of the effect and level of biological organization affected[3]	Likelihood the effect will occur or continue[4]	Relative importance of the affected area to the surrounding habitat[5]	Extent to which the affected area is highly sensitive or ecologically unique[6]	Recovery potential of the affected receptor and chemical persistence[7]	
Muskrat			Moderate risk - arsenic in diet in Reaches 0, 1 & 2. Modeling with high uncertainty. Uncertain population effects.			No	U / L [8, 9]	L	U / M [10]	U / M	U / M [11]	No
River Otter		Low risk. Modeling with moderate uncertainty.				No	n / a	n / a	n / a	n / a	n / a	No
Green Heron	Negligible Risk Potential Low Uncertainty.					No	n / a	n / a	n / a	n / a	n / a	No
Mallard		Low risk due to metals in limited area of Reach 1. Modeling with moderate uncertainty.				No	U / L [8, 9]	L	U / L [10]	U / L	U / L [11]	No

TABLE 1-5 (cont.)
SUMMARY OF RISK CONCLUSIONS - MSGRP RI STUDY AREA
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Receptor/ Endpoint	INCREASING LEVEL OF RISK FROM NEGLIGIBLE TO HIGH → → → → → → →					Ecological Significance [1]						Unacceptable Ecological Risk[15]
	Negligible Risk Potential Low Uncertainty	Low Risk Potential Increased Uncertainty	Moderate Risk High Uncertatinty	Moderate/High Risk Decreased Uncertainty	High Level of Impacts Low Uncertainty	Endangered or sensitive species[2]	Magnitude of the effect and level of biological organization affected [3]	Likelihood the effect will occur or continue [4]	Relative importance of the affected area to the surrounding habitat [5]	Extent to which the affected area is highly sensitive or ecologically unique[6]	Recovery potential of the affected receptor and chemical persistence [7]	
Northern Short-tailed Shrew		Low risk - arsenic in diet. Modeling with high uncertainty. Uncertain population effects.				No	U / L [8, 9]	L	U / L [10]	L	U / L [11]	No
Warmwater fish populations	Reaches 2 to 6 with low risk based on tissue data. Uncertain risk in Reach 1.	HBHA Pond and HBHA Wetlands with low risk based on tissue arsenic data. Some exceedences of tissue benchmarks. Uncertain population effects.				No	L [9, 12]	L	U / L [10]	L	L [13]	No
Benthic Invertebrate Communities		HBHA wetland and Reaches 1 & 2 with Low/uncertain toxicity and communtiy impairment.		HBHA Pond with high risk based on severe toxicity and community impairment. High tissue metals.		No	U / M [9, 14]	L	L	L	L [13]	Yes

TABLE 1-5 (cont.)
SUMMARY OF RISK CONCLUSIONS - MSGRP RI STUDY AREA
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

RATING: L = LOW, M = MODERATE, H = HIGH , U = UNCERTAIN , n / a = NEGLIGIBLE RISK, or not applicable

NOTES:

1 Ecological significance is defined in USEPA (1997) or OSWER Directive 9285.7-28, "Ecological Risk Assessment and Risk Management Principles for Superfund Sites," dated October 7, 1999. The six categories address the factors recommended in the OSWER guidance to be considered in evaluating the significance of ecological effects. The magnitude of the potential risk was considered in evaluating the significance of each factor; a low risk to the receptor generally equates to low ecological significance.

2 No endangered species were identified. The affected populations do not represent other known species with sensitivity to the chemical of potential concern (arsenic).

3 The magnitude of the observed or predicted ecological effects and level of biological organization affected (individual, local population, or community).

4 The likelihood that effects will occur or continue in terms of bioaccumulation or biomagnification into the food chain.

5 The extent to which the affected area is important to the functioning of the surrounding habitat (e.g., wildlife migration corridor, overwintering habitat, etc.).

6 The degree to which the affected area itself (directly) represents highly sensitive or ecologically unique (essential) habitat to the receptor population (e.g., nursery habitat).

7 The likelihood an affected receptor will not recover from the effect of site releases (i.e., species has long generation time or limited foraging range, chemical persistance in the environment).

8 There is high uncertainty in the magnitude of risk because it was estimated using modeling methods without any direct measure of effect (no model verification).

9 Loss of individuals or effects on reproduction may be mitigated in the affected area by immigration from nearby habitats (recruitment from the regional population).

10 Halls Brook and the Aberjona River could function as migration corridors to wildlife and fish, however, it is uncertain whether they are used for this purpose.

11 Receptor has generation time that is moderately short, sediment arsenic is persistent in the affected area, but not fully bioavailable because of chelation to iron.

12 No population effect was detected in Reaches 1 to 6 based on tissue data, however, no fish tissue samples were collected in Reach 1. Tissue concentrations of arsenic exceeded benchmarks in Reach 0. Population effects uncertain in Reach 0.

13 Receptor has generation time that is short (invertebrates) or moderately short (fish), sediment arsenic is persistent in the affected area, but not fully bioavailable because of chelation to iron.

14 Triad analysis (chemical, biological, and ecological field sampling) identified a high magnitude of effect in the HBHA Pond, however, downgradient of the pond there was lower community effects associated with higher uncertainty.

15 Unacceptable Risk is defined in USEPA (see footnote 1) as a predicted impact to a local population or community of sufficient magnitude, severity, areal extent, and duration that they will not be able to recover and/or maintain themselves in a healthy state. Additionally, these effects are predicted to exceed the natural variation in similar reference areas.

TABLE 2-1
POTENTIAL CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
Federal Regulatory Requirements	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Potentially Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Any alternative that involves discharges to surface waters may need to include treatment to comply with NPDES. Massachusetts' federally-approved NPDES permit program is outlined in 314 CMR 3.00.
	National Recommended Water Quality Criteria [Clean Water Act-Section 304(a)(1)]	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	NAWQC may be used in determining PRGs for surface water.
	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Potentially Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established. Federal AWQC are to be considered in determining effluent discharge limits. Where recommended limits are not available, site-specific limits shall be developed.	Discharges of water (in the form of dewatering effluent, groundwater treatment system effluent, etc.) to surface water bodies will be governed by this regulation.
	Massachusetts Ground Water Discharge Permit Program (314 CMR 5.00)	Potentially Applicable	Groundwater discharges shall not result in a violation of Massachusetts Surface Water Quality Standards (314 CMR 4.00) or Massachusetts Ground Water Quality Standards (314 CMR 6.00).	Remedial alternatives that include groundwater discharge will need to comply with this regulation.

TABLE 2-1 (cont.)
POTENTIAL CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
State Regulatory Requirements	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards designate and assign uses for which groundwater in the Commonwealth shall be managed and protected, and set forth water quality criteria necessary to maintain the designated areas.	GW-3 and GW-1 standards apply to the site. These classifications will dictate the remedial goals that must be met for groundwater.
	Massachusetts Contingency Plan, Method 1 Groundwater Standards, 310 CMR 40.0974(2)	Relevant and Appropriate	The MCP has established a set of risk-based threshold concentrations that must be attained in order to achieve a condition of no significant risk for groundwater within a particular groundwater classification area.	Method 1 standards will be considered during the development of PRGs for groundwater and soils.
	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Potentially Applicable	The applicable portions of this regulation establish requirements for the design and construction of Contaminated Groundwater Treatment Systems (CGTS) within the Commonwealth of Massachusetts. These include instrumentation requirements and record keeping requirements to ensure compliance with the emission standards. This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	Any groundwater treatment system that includes point-source air emissions as part of the treatment process would need to comply with these requirements. Remedial actions that involve excavation of any type must be designed to minimize fugitive emissions of any type.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants, and will be used in the derivation of PRGs for the FS.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RFDs were used to evaluate health risks associated with site-related contaminants, and will be used in the derivation of PRGs for the FS.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	These advisories and guidance documents may be used in the derivation of PRGs for the FS.

TABLE 2-2
POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Potentially Applicable	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and the Order emphasizes the importance of avoiding new construction or harm to wetlands unless there is no practicable alternative to such construction.	Any alternative that includes activities within wetland areas that might result in the destruction, loss, or degradation of wetlands will need to comply with this order.
	Executive Order for Floodplain Management Exec Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Potentially Applicable	Federal agencies are required to avoid impacts associated with the occupancy and modification of a floodplain and avoid support of floodplain development wherever there is a practicable alternative.	Any alternative that includes activities within floodplain areas that might result in the occupancy or modification of the floodplain will need to comply with this order.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices (40 CFR 257.3-1)	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Alternatives whose implementation may impact the flood storage capacity of the areas adjacent to surface water bodies will be designed, to the extent practicable, to avoid impacts that would violate this regulation.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Alternatives that might impact floodplains through washout or accidental transport of contaminated media into floodplain areas will be designed to prevent such events from occurring.
	16 USC 661 et. Seq., Fish and Wildlife Coordination Act (50 CFR Parts 81, 226, 402)	Potentially Applicable	Federal agencies are required to consider the effect that water-related projects will have on fish and wildlife; and to consult with the state to develop measures to prevent, mitigate, or compensate for project-related losses of fish and wildlife.	Alternatives that involve actions that might impact fish and wildlife will require consultation with the Fish and Wildlife Service to develop appropriate measures to protect resources.

TABLE 2-2 (cont.)
POTENTIAL LOCATION-SPECIFIC ARARs AND TBCs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS
PAGE 2 OF 2

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, (310 CMR 10.00)	Potentially Applicable	These regulations are promulgated under Wetlands Protection Laws, which regulate dredging, filling, altering, or polluting of wetlands. Work within 100 feet of a wetland is regulated under this requirement.	Any work conducted within wetlands will be subject to compliance with these regulations.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Alternatives that include dredging of sediment will require compliance with these regulations
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Alternatives that include dredging of sediment will require compliance with these regulations

TABLE 2-3
POTENTIAL ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Any plans for actions within wetland areas must comply with this requirement, and practicable alternatives to the destruction of wetlands or occupancy/modification of floodplains must be explored.
	Executive Order for Floodplain Management Exec. Order 11988 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Any plans for actions within floodplain areas must comply with this requirement, and practicable alternatives to the destruction of wetlands or occupancy/modification of floodplains must be explored.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	Contaminated soils/sediments will be assessed using this criteria to determine whether they should be managed as hazardous waste.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	These regulations may be relevant and appropriate for soil alternatives if soil is sufficiently contaminated to warrant a hazardous classification.

TABLE 2-3 (cont.)
POTENTIAL ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
Federal Regulatory Requirements (cont.)	Clean Water Act §404 and regulations, 33 USC 1344, 40 CFR 230	Potentially Applicable	No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the discharge which would have a less adverse impact to the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.	Permits must be acquired where activities are conducted within an aquatic environment. The permit application must show that appropriate and practicable steps have been taken to minimize the potential adverse impacts of the discharge on the aquatic ecosystem.
	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J	Applicable	Subpart A of Part 262 provides that a generator who treats, stores, or disposes of hazardous waste on-site must determine whether or not he has a hazardous waste, obtain an EPA identification number for any hazardous waste and comply with the regulations regarding accumulation of hazardous waste and recordkeeping. Subparts I and J of Part 264 identify design, operating, monitoring, closure, and post-closure care requirements for long-term storage of RCRA hazardous waste in containers and tank systems, respectively. However, Section 262.34(a) allows accumulation of RCRA hazardous wastes for up to 90 days in containers or tanks provided generator complies with requirements of Subparts I and J of Part 265.	Any free product, drums, or contaminated equipment will be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations will also be complied with for any off-site disposal.
	Fish and Wildlife Coordination Act (16 USC 166 et. Seq)	Potentially Applicable	Any modification of a body of water requires prior consultation with the U.S. FWS to develop measures to prevent, mitigate, or compensate for losses to fish and wildlife.	Any alternative that involves modifications to water bodies must comply with this requirement.

TABLE 2-3 (cont.)
POTENTIAL ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
Federal Regulatory Requirements (cont)	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Potentially Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Any alternative that involves discharge of water into surface water bodies (in the form of dewatering effluent, groundwater treatment system effluent, etc.) would need to comply with this requirement.
	National Recommended Water Quality Criteria Clean Water Act, Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This regulation will be considered for any alternative that involves discharges to surface water bodies.
State Regulatory Requirements	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Potentially Applicable	The applicable portions of this regulation establish requirements for the design and construction of Contaminated Groundwater Treatment Systems (CGTS) within the Commonwealth of Massachusetts. These include instrumentation requirements and record keeping requirements to ensure compliance with the emission standards. This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	Any groundwater treatment system that includes point-source air emissions as part of the treatment process would need to comply with these requirements. Remedial actions that involve excavation of any type must be designed to minimize fugitive emissions of any type.
	Massachusetts Wetlands Protection Act and Regulations (310 CMR 10.00)	Potentially Applicable	This regulation defines the process through which local conservation commissions and MADEP may enforce state wetland regulations. The potentially applicable portions of this regulation include restrictions on activities that remove, fill, dredge, or alter wetlands or activities conducted within wetland buffer zones (within 100 feet of a wetland).	Any alternative that includes removal, fill, dredging, or alterations of wetland areas must comply with this regulation.

TABLE 2-3 (cont.)
POTENTIAL ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION FOR FEASIBILITY STUDY
State Regulatory Requirements (cont)	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Potentially Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established. Federal AWQC are to be considered in determining effluent discharge limits. Where recommended limits are not available, site-specific limits shall be developed.	Discharges of water (in the form of dewatering effluent, groundwater treatment system effluent, etc.) to surface water bodies will be governed by this regulation.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth (314 CMR 9.06)	Potentially Applicable	The substantive portions of these regulations establish criteria and standards for the dredging, handling, and disposal of fill material and dredged material.	Remedial alternatives involving the dredging, handling, and disposal of material will need to comply with this regulation.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth (314 CMR 9.07)		The substantive portions of these regulations establish criteria and standards for the dredging, handling, and disposal of fill material and dredged material.	Remedial alternatives involving the dredging, handling, and disposal of material will need to comply with this regulation and impacts to fisheries in the area must be avoided.
	Massachusetts - Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste), (310 CMR 30.300, 30.680, 30.690 and 310 CMR 30.340)	Potentially Applicable	Requirements for transport and long-term storage of RCRA hazardous waste in containers and tank systems	Remedial alternatives that include on-site storage or offsite transportation and disposal of contaminated material will need to comply with this regulation.

TABLE 2-4
SUMMARY OF REMEDIAL ACTION OBJECTIVES
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GROUNDWATER [1]	
Industri-plex Site and HBHA Pond Area	**► Prevent exposures associated with a HI > 1 and/or ILCR > 10^{-6} to 10^{-4} by meeting the associated PRGs for the following scenarios:** ● *Ingestion, dermal contact, and/or vapor inhalation of arsenic, benzene, trichloroethene, 1,2-dichloroethane, and naphthalene by an industrial worker using groundwater as process water* ● *Ingestion and dermal contact of arsenic by an excavation worker* ● *Vapor inhalation of benzene, trichloroethene, and 1,2-dichloroethane by a car wash worker using groundwater in the car wash* **► *Protect benthic invertebrates and aquatic life from exposure to levels of benzene and arsenic indicative of impairment due to groundwater discharges or provide alternate habitat (HBHA Pond only) .***
SEDIMENT [2]	
Wells G&H 38-acre Wetland (edges of wetland only); Cranberry Bog Conservation Area (edges of wetland only); HBHA and Wells G&H Wetland Areas	**► Prevent exposures associated with a HI > 1 and/or ILCR > 10^{-6} to 10^{-4} by meeting the associated PRGs for the following scenarios:**
	● *Ingestion and dermal contact of accessible arsenic and benzo(a)pyrene for current and future recreational land use*
	● *Ingestion and dermal contact of accessible arsenic for current and future recreational land use*
	● *Ingestion and dermal contact of arsenic for future dredging workers*
HBHA Pond	**► Protect benthic invertebrates from toxicological impacts indicative of impairment or provide alternate habitat.**
	► Minimize to the extent practicable, the migration of soluble and particulate arsenic during storm events to downstream depositional areas.
SOIL	
Former Mishawum Lake Bed Area	**► Prevent exposures associated with a HI > 1 and/or ILCR > 10^{-6} to 10^{-4} by meeting the associated PRGs for the following scenarios:** ● *Ingestion and dermal contact of arsenic by children at a future day care center for surface and subsurface soil* ● *Ingestion and dermal contact of arsenic by a future excavation worker for subsurface soil*
SURFACE WATER	
HBHA Pond	**► *Protect aquatic life from arsenic and benzene above levels indicative of impairment or provide alternate habitat in the event that the HBHA Pond is used as a component of the remedy. Meet ARARs for the protection of aquatic life***

Notes:

(1) Institutional controls should control all groundwater uses unless site-specific risk assessment demonstrates risks and hazards below risk management guidelines for the proposed groundwater use. The most conservative exposure scenarios have been considered in the establishment of groundwater PRGs.
(2) Prevent human exposure to wetland areas not evaluated if the remedial alternative increases accessibility
HI - Hazard Index
ILCR - Incremental Lifetime Cancer Risk
PRGs - Preliminary Remediation Goal

TABLE 2-5A
HUMAN HEALTH PRELIMINARY REMEDIATION GOALS (PRGs)
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Medium	Location/COC	PRGs				Additional Information			
		ILCR				Site-specific Background Levels			MADEP Regional
		10^{-6}	10^{-5}	10^{-4}	HQ = 1	Range	Mean	95%UCL	Background
Sediment - mg/kg (Recreational Scenario)	**CB-03**								
	Arsenic	4	40	400	230	3.8 - 40.6	21	33	- -
	WH, NT-3, 13/TT-27								
	Arsenic	5.0	50	500	300	3.8 - 40.6	21	33	- -
	Benzo(a)pyrene	0.4	4	40	N/A	0.13 - 5.5	1.3	4.9	- -
Sediment Cores - mg/kg (Dredging Scenario)	**SC02, SC05, SC06, SC08**								
	Arsenic	30	300	3000	400	3.8 - 40.6	21	33	- -
Surface and Subsurface Soil - mg/kg (Day Care Child Scenario)	**Former Mishawum Lake Bed Area**								
	Arsenic	1	10	100	50	- -	- -	- -	20
Subsurface Soil - mg/kg (Construction Worker Scenario)	**Former Mishawum Lake Bed Area**								
	Arsenic	40	400	4000	300	- -	- -	- -	20
Shallow Groundwater - µg/L (Construction Worker Scenario)	**Site-wide**								
	Arsenic	200	2000	20000	1200	- -	- -	- -	5.5
Groundwater - µg/L (Process Water Scenario)	**Site-wide**								
	1,2-Dichloroethane	0.2	2	20	8	- -	- -	- -	- -
	Benzene	0.6	6	60	50	- -	- -	- -	- -
	Trichloroethene	0.04	0.4	4	70	- -	- -	- -	- -
	Naphthalene	N/A	N/A	N/A	5	- -	- -	- -	- -
	Arsenic	4	40	400	600	- -	- -	- -	5.5
Groundwater - µg/L (Car Wash Scenario)	**Site-wide**								
	1,2-Dichloroethane	0.2	2	20	7	- -	- -	- -	- -
	Benzene	0.4	4	40	30	- -	- -	- -	- -
	Trichloroethene	0.03	0.3	3	50	- -	- -	- -	- -
	Naphthalene	N/A	N/A	N/A	6	- -	- -	- -	- -

Notes:
N/A - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects
Site-specific background information from Appendix C.1 of the Baseline Human Health and Ecological Risk Assessment for the Aberjona River Study (September 2004).
Soil regional background values from the MADEP "Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil" (May 2002).
Groundwater regional background value from the MADEP "Background Documentation for the Development of the MCP Numerical Standards" (April 1994).
HQ = Hazard Quotient
ILCR = Incremental Lifetime Cancer Risk
UCL = Upper Confidence Limit

TABLE 2-5B
PROPOSED PRELIMINARY REMEDIATION GOALS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

MEDIA	LOCATION	PRG	HQ	ILCR
SEDIMENT	**Cranberry Bog Conservation Area: CB03**			
	Arsenic	230 mg/kg	1	6.E-05
	Wells G&H Wetland: WH Series, NT-3, SD-13/TT27			
	Arsenic	300 mg/kg	1	6.E-05
	Benzo(a)pyrene	4.9 mg/kg	NE	1.E-05
		Cumulative Risk/Hazard	1	7.E-05
	Sediment Cores: SC02, SC05, SC06, SC08			
	Arsenic	300 mg/kg	0.8	1.E-05
	HBHA Pond (ecological)			
	Arsenic	273 mg/kg	(1)	(1)
SOIL	**Surface Soil and Subsurface Soil - Former Mishawum Lake Bed Area**			
	Arsenic	50 mg/kg	1	4.E-05
GROUNDWATER	**Industri-plex Site and HBHA Pond Area**			
	Arsenic	150 ug/L	0.3	4.E-05
	Benzene	4 ug/L	0.1	1.E-05
	1,2-Dichloroethane	2 ug/L	0.3	1.E-05
	Trichloroethene	1 ug/L	0.02	3.E-05
	Naphthalene	5 ug/L	1	NE
		Cumulative Risk/Hazard	1 (2)	9.E-05
SURFACE WATER	**HBHA Pond (ecological)**			
	Arsenic (1)	150 ug/L	(3)	(3)
	Benzene (1)	46 ug/L	(4)	(4)

Notes:
HQ = Hazard Quotient
ILCR = Incremental Lifetime Cancer Risk
COC = Chemical of Concern
NRWQC = National Recommended Water Quality Criterion
MCL = Maximum Contaminant Level
NE = Not evaluated due to lack of cancer or noncancer toxicity values
(1) Toxicity testing results are used as the basis for the PRG
(2) Target organ HQ is presented as the cumulative hazard.
(3) The NRWQC value is selected as the surface water PRG for arsenic
(4) The Tier II value is selected as the surface water PRG for benzene

Cumulative risks and hazards, summed for COCs, are for the most conservative receptor and scenario from Table 2-5a.

TABLE 2-6
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Soil	Protection of Human Health Prevent exposures associated with a Hazard Index (HI) greater than 1.0 and/or an Incremental Lifetime Cancer Risk (ILCR) greater than 10^{-6} to 10^{-4} by meeting the associated PRGs for the following scenarios: • Ingestion and dermal contact of arsenic by children at a future day care center for surface and subsurface soil. • Ingestion and dermal contact of arsenic by a future excavation worker for subsurface soil.	No Action	No Action	- not applicable
		Limited Action	Institutional Controls	- deed restrictions
			Access Restrictions	- fencing/signage
			Monitoring	- soil sampling
			Natural Attenuation	- monitored natural attenuation
		Containment	Horizontal Barriers	- impermeable cap - permeable cover
		Removal	Excavation	- mechanical excavation
		Treatment	Immobilization	- solidification/stabilization
			Thermal Treatment	- incineration - pyrolysis - vitrification - thermal desorption - pyrometallurgical recovery
			Physical Treatment	- soil washing - soil vapor extraction - physical separation - electrical separation
			Chemical Treatment	- acid extraction - chemical reduction/oxidation
			Biological Treatment	- enhanced bioremediation - bioventing - phytoremediation - land farming/biopiles
		Disposal	On-Site Disposal	- consolidation and capping - on-site reuse
			Off-Site Disposal	- commercial landfill

TABLE 2-6 (cont.)
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Sediment	Protection of Human Health Prevent exposures associated with a HI greater than 1.0 and/or ILCR greater than 10^{-6} to 10^{-4} by meeting the associated PRGs for the following scenarios: • Ingestion and dermal contact of arsenic and benzo(a)pyrene for current and future recreational land use. • Ingestion and dermal contact of arsenic for current and future recreational land use. • Ingestion and dermal contact of arsenic for future dredging workers. Protection of the Environment Protect benthic invertebrates from toxicological impacts indicative of impairment or provide alternate habitat. Reduce the migration of soluble and particulate arsenic during storm events to downstream depositional areas.	No Action	No Action	- not applicable
		Limited Action	Institutional Controls	- deed restrictions
			Access Restrictions	- fencing/signage
			Monitoring	- sediment sampling
			Natural Recovery	- monitored natural recovery - enhanced natural recovery
		Containment	Horizontal Barriers	- subaqueous cap
			Vertical Barriers	- silt curtain/silt screen
			Surface Water Controls	- sediment retention - stormwater bypass
		Removal	Dredging	- mechanical dredging - hydraulic dredging
			Excavation	- mechanical excavation
		Treatment	Immobilization	- solidification/stabilization
			Thermal Treatment	- incineration - pyrolysis - vitrification - thermal desorption
			Physical Treatment	- dewatering - soil washing - physical separation - electrical separation
			Chemical Treatment	- acid extraction - chemical reduction/oxidation
			Biological Treatment	- enhanced bioremediation - land farming - phytoremediation

TABLE 2-6 (cont.)
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Sediment (cont.)	Protection of the Environment (cont)	Disposal	On-Site Disposal	- open-water disposal - consolidation and capping - on-site reuse
			Off-Site Disposal	- commercial landfill
Groundwater	Protection of Human Health Prevent exposures associated with a HI greater than 1.0 and/or ILCR greater than 10-6 to 10-4 by meeting the associated PRGs for the following scenarios: • Ingestion, dermal contact, and/or vapor inhalation or arsenic, benzene, trichloroethene, and 1,2-dichloroethane by an industrial worker using groundwater as a process water. • Ingestion and dermal contact of arsenic by an excavation worker. • Vapor inhalation of benzene, trichloroethene, and 1,2-dichloroethane by a car wash worker using groundwater in the car wash. Protection of the Environment Protect benthic invertebrates and aquatic life from exposure to levels of benzene and arsenic indicative of impairment due to groundwater discharges to the HBHA Pond, or provide alternative habitat.	No Action	No Action	- not applicable
		Limited Action	Institutional Controls	- deed restrictions
			Monitoring	- groundwater monitoring
			Natural Attenuation	- monitored natural attenuation
		Containment	Horizontal Barriers	- low permeability cap - permeable cover
			Vertical Barriers	- slurry wall - grout injection - sheet piling
			Hydraulic Containment	- extraction wells
		Collection	Extraction	- vertical extraction wells - collection trench - directional wells
		Ex-situ Treatment	Ex-situ Physical Treatment	- equalization - dewatering - sedimentation - oil-water separation - filtration - nanofiltration - reverse osmosis - bioslurping - air stripping - adsorption - distillation - evaporation

TABLE 2-6 (cont.)
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Groundwater (cont)	Protection of the Environment (cont)	Ex-situ Treatment (cont.)	Ex-situ Chemical Treatment	- ion exchange - chemical oxidation - UV oxidation - neutralization - precipitation/coprecipitation - flocculation - dechlorination - zero-valent iron - Fenton's reagent
			Ex-situ Biological Treatment	- aerobic biodegradation - anaerobic biodegradation
		Discharge	Beneficial Re-Use	- on-site re-use
			Surface Discharge	- direct discharge - indirect discharge
			Subsurface Discharge	- infiltration gallery - deep well injection
		In-situ Treatment	Monitored Natural Attenuation	- biological processes - chemical processes - physical processes
			In-situ Physical Treatment	- air sparging w/ SVE
			In-situ Chemical Treatment	- permeable reactive barrier - in-situ chemical oxidation
			In-situ Biological Treatment	- enhanced bioremediation - constructed wetlands - hydrogen release compound

TABLE 2-6 (cont.)
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Surface Water	Protection of Environment Protect aquatic life from arsenic and benzene above levels indicative of impairment or provide alternate habitat. Meet ARARs for the protection of aquatic life.	No Action	No Action	- not applicable
		Limited Action	Institutional Controls	- deed restrictions
			Monitoring	- surface water monitoring
			Natural Attenuation	- monitored natural attenuation
		Containment	Horizontal Barriers	- impermeable cap
			Hydraulic Containment	- extraction points
		Collection	Extraction	- vertical extraction points
		Ex-situ Treatment	Ex-situ Physical Treatment	- equalization - dewatering - sedimentation - oil-water separation - filtration - nanofiltration - reverse osmosis - bioslurping - air stripping - adsorption - distillation - evaporation
			Ex-situ Chemical Treatment	- ion exchange - chemical oxidation - UV oxidation - neutralization - precipitation/coprecipitation - flocculation - dechlorination - zero-valent iron - Fenton's reagent
			Ex-situ Biological Treatment	- aerobic biodegradation - anaerobic biodegradation

TABLE 2-6 (cont.)
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
TECHNOLOGY TYPES, AND PROCESS OPTIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Environmental Medium	Remedial Action Objectives (from site characterization)	General Response Action (for all remedial action objectives)	Remedial Technology Types (for general response actions)	Process Options
Surface Water (cont)	Protection of the Environment (cont)	Discharge	Beneficial Re-Use	- on-site re-use
			Surface Discharge	- direct discharge - indirect discharge
		In-situ Treatment	Monitored Natural Attenuation	- biological processes - chemical processes - physical processes
			In-situ Oxidation/Aeration	- air injection - pumping with aeration (fountain)

TABLE 2-7
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
No Action	No Action	No Action	No on-site actions taken to address soil contamination.	Retained for baseline comparison purposes in accordance with the National Contingency Plan.
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as excavation or residential development could be restricted under property deeds.	Potentially applicable.
	Access Restrictions	Fencing/Signage	Physically restrict access to contaminated soils by implementing a fence and posted signs.	Eliminated. Not feasible in areas of site where contaminated surface soil has been identified.
	Monitoring	Soil Sampling	Periodic sampling and analysis of soil to assess contaminant fate and transport, and natural degradation of contaminants.	Potentially applicable.
	Natural Attenuation	Monitored Natural Attenuation	Natural subsurface and surface biological, chemical, or physical processes attenuate organics and inorganics, and limit migration of some contaminants.	Potentially applicable.
Containment	Horizontal Barriers	Impermeable Cap	Asphalt, concrete, geosynthetics, or multimedia materials are used to form an impermeable barrier to prevent direct contact with contaminated material and to minimize leaching of contaminants to groundwater.	Potentially applicable.
		Permeable Cover	Soil, crushed stone, geosynthetics, and vegetative cover used to prevent direct contact with contaminated soil and minimize erosion and surface migration of contaminated soil.	Potentially applicable.
Removal	Excavation	Mechanical Excavation	Use of common construction equipment to remove contaminated soil. Excavation would be a prerequisite to any other process option that is performed ex-situ.	Retained as the representative technology for soil removal at the Site.
Treatment	Immobilization	Solidification / Stabilization	Soil mixing equipment used to mix reagents with contaminated soil to physically and/or chemically decrease the mobility of contaminants. Treatment could be implemented in-situ or ex-situ.	Potentially applicable. Most commonly used treatment process for soil contaminated with arsenic.

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Treatment (cont.)	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment would be done ex situ.	Eliminated. Not effective for the treatment of soils containing inorganic contaminants.
		Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment would be done ex situ.	Eliminated. Not effective for the treatment of soils containing inorganic contaminants.
		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment may be done in situ or ex situ.	Eliminated. Emerging technology, not yet proven at full scale to be an effective treatment method for soil contaminated with arsenic.
		Thermal Desorption	Volatile and semi-volatile compounds are separated from sediments by heating the sediment to temperatures ranging from 90 to 540 degrees Celsius.	Eliminated. Not effective for the treatment of soils containing inorganic contaminants.
		Pyrometallurgical Recovery	Heat is used to convert metals-contaminated waste into a product with a high metals concentration that can be reused or sold.	Eliminated. In order to make recovery economically feasible, high concentrations (>10,000 mg/kg) are necessary.
	Physical Treatment	Soil Washing	Contaminants sorbed onto fine soil particles are separated by particle size from bulk soil in a water-based system. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	Eliminated. Acid extraction (described below) is a similar process that will be retained for further evaluation.
		Soil Vapor Extraction	In situ technology in which vacuum blowers and extraction wells are used to strip volatile organic compounds from unsaturated soil. Treatment would be done in situ.	Eliminated. Not effective for the treatment of soils containing inorganic contaminants.
		Physical Separation	An ex-situ process using gravity, magnetic, sieving, or physical separation techniques. Typically used to remove oversized material and debris to produce an acceptable feed material for subsequent handling and/or treatment.	Potentially applicable. Could be used as a pre-treatment process to improve the performance of a downstream treatment process.

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Treatment (cont.)	Physical Treatment (cont.)	Electrical Separation	Electrical separation relies upon the application of low-intensity direct current through the soil between ceramic electrodes that are divided into a cathode array and an anode array. This mobilizes charged species, causing ions and water to move toward the electrodes.	Eliminated. Emerging technology, few commercial applications with which to demonstrate effectiveness.
	Chemical Treatment	Acid Extraction	Contaminated soil and extractant (usually an organic solvent or an acid) are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use.	Potentially applicable.
		Chemical Reduction / Oxidation	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potentially applicable.
	Biological Treatment	Enhanced Bioremediation	The activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in situ biological degradation of organic contaminants or immobilization of inorganic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials.	Eliminated. Not applicable to the treatment of arsenic in soil.
		Bioventing	Oxygen is directly injected into unsaturated subsurface soils via a network of air injection wells at air flow rates adequate to sustain microbial activity.	Eliminated. Not effective at treating inorganic contaminants.
		Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil. Target contaminants may be either organic or inorganic.	Eliminated. Soil contamination areas not amenable to phyto-remediation since they are currently occupied by operating businesses and/or functional asphalt surfaces.

TABLE 2-7 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Treatment (cont.)	Biological Treatment (cont.)	Land Farming Biopiles Composting	These ex-situ biological processes are solid-phase bioremediation technologies in which contaminated soils are placed in a cell or building and tilled with added water and nutrients to promote biological degradation of contaminants.	Eliminated. Most effective at treating fuel-related soil contamination. Ineffective at treating inorganic contaminants.
Disposal	On-Site Disposal	Soil Consolidation and Capping	Disposal of contaminated soil in a specially-constructed on-site consolidation cell that includes a bottom liner for leachate collection and a low permeability cover to prevent the infiltration of precipitation.	Potentially applicable.
		On-Site Reuse	Reuse of treated soil as fill or backfill at an on-site location(s).	Potentially applicable.
	Off-Site Disposal	Commercial Landfill	Disposal of excavated contaminated soil at an off-site, RCRA Subtitle D compliant disposal facility.	Potentially applicable.

Notes:

1. General response actions, remedial technologies, and process options for soil were adapted from Table 2-6.
2. Process options were retained or eliminated based on an evaluation of their technical implementability given the contaminant types and concentrations in soil, and other relevant site characteristics.

TABLE 2-8
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
No Action	No Action	No Action	No active remediation conducted to address groundwater contamination.	Retained for baseline comparison purposes in accordance with the National Contingency Plan.
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as groundwater extraction/use or residential development could be restricted under property deeds.	Potentially applicable.
	Monitoring	Groundwater Sampling	Periodic sampling and analysis of groundwater to assess contaminant leaching and migration.	Potentially applicable.
	Natural Attenuation	Monitored Natural Attenuation	Natural subsurface biological, chemical, or physical processes attenuate dissolved organics and inorganics, and limit migration of some contaminants.	Potentially applicable.
Containment	Horizontal Barriers	Low Permeability Cap	Clay, asphalt, concrete, or multi-media cover over areas of contamination to minimize leaching of contaminants from soil into groundwater.	Potentially applicable.
		Permeable Cover	Crushed stone or vegetative cover to prevent direct contact and minimize erosion and surface migration of contaminated soils.	Potentially applicable.
	Vertical Barriers	Slurry Wall	Vertically excavated trenches filled with slurry. The slurry, usually a mixture of bentonite and water, hydraulically shores the trench to prevent collapse and retards ground water flow.	Eliminated. Would be difficult to create complete containment barrier due to the depth to bedrock in the center of the Study Area.
		Grout Injection	Use of pressure-injected grout to form impermeable or semi-impermeable barrier to restrict horizontal migration of contaminants.	Eliminated. Would be difficult to create complete containment barrier due to the depth to bedrock in the center of the Study Area.
		Sheet Piling	Sheet piles are driven vertically into the subsurface and linked to each other to form a continuous physical barrier to groundwater flow. Used to change groundwater flow.	Eliminated. Would be difficult to create complete containment barrier due to the depth to bedrock in the center of the Study Area.

TABLE 2-8 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Containment (cont.)	Hydraulic Containment	Extraction Wells	Configuration of extraction wells installed perpendicular to direction of groundwater flow designed to capture flow and prevent containment migration.	Potentially applicable. Hydraulic containment would likely be an ancillary benefit of groundwater extraction using vertical extraction wells (see below).
Collection	Extraction	Vertical Extraction Wells	Discrete pumping wells are used to collect contaminated groundwater for ex-situ treatment.	Potentially applicable. Effective and implementable method for groundwater extraction.
		Collection Trench	Permeable trench used to intercept and collect contaminated groundwater for treatment.	Potentially applicable. Effective and implementable method for groundwater collection/extraction.
		Directional Wells	Drilling techniques are used to position wells horizontally, or at an angle, to reach contaminants not accessible by direct vertical drilling.	Eliminated. Groundwater contamination plumes are accessible using more traditional, and more easily implementable, vertical extraction wells.
	Enhanced Removal	Blasting / Fracturing	Blasting or fracturing of bedrock or low-permeability overburden materials to promote access to groundwater in bedrock fractures.	Eliminated. Contamination relegated to overburden aquifer, which consists of high permeability material.
		Hydrofracturing	Injection of pressurized water through wells cracks low permeability and over-consolidated sediments. Cracks are filled with porous media that serve as substrates for bioremediation or to improve pumping efficiency	Eliminated. Overburden material has adequate permeability and pore space to support in-situ treatment without hydrofracturing.
Ex-Situ Treatment	Ex-Situ Physical Treatment	Equalization	Dampening of flow and/or contaminant concentration variation in a large vessel to promote constant discharge rate and water quality.	Potentially applicable. Effective and implementable process that would improve the performance of an ex-situ groundwater treatment system.
		Dewatering	Mechanical removal of free water from treatment residuals using equipment such as a filter press or vacuum filter.	Potentially applicable. Treatment residuals likely to result from ex-situ treatment of groundwater containing inorganic contaminants.

TABLE 2-8 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment (cont.)	Ex-Situ Physical Treatment (cont.)	Sedimentation	Gravity settling of suspended solids from water in a vessel.	Potentially applicable. Could be used as a pre-treatment process to improve the performance of an ex-situ treatment process.
		Oil/Water Separation	Separation of oils or other non-aqueous phase liquids from water by forces of gravity.	Eliminated. Effective process option for removal of free product. No product observed at site to date.
		Filtration	Separation of material from water via entrapment in a bed or membrane separation.	Potentially applicable as treatment option for groundwater contaminated with arsenic or other inorganic contaminants.
		Nanofiltration	Membrane filtration process that uses high pressure to separate dissolved contaminants from water by passing them through a semi-permeable barrier or membrane.	Potentially applicable as a treatment option for groundwater contaminated with arsenic or other inorganic contaminants.
		Reverse Osmosis	Use of high pressure and membranes to separate dissolved materials, including organics and inorganics, from water.	Potentially applicable as treatment option for groundwater contaminated with arsenic or other inorganic contaminants.
		Bioslurping	Bioslurping combines the two remedial approaches of bioventing and vacuum-enhanced free-product recovery.	Eliminated. Mainly used for LNAPL recovery. No LNAPL observe at site to date.
		Air Stripping	Transfer of volatile organic compounds from the aqueous phase to the vapor phase through contact of contaminated water with air or steam in a countercurrent process.	Potentially applicable as treatment option for groundwater contaminated with benzene, TCE, and/or 1,2-DCA.
		Adsorption	Adsorption of aqueous phase contaminants onto the surface of a sorbent such as activated carbon, activated alumina, or manganese greensand.	Potentially applicable as a treatment option for groundwater contaminated with benzene, TCE, 1,2-DCA, and/or arsenic.
		Distillation	Vaporization of a liquid followed by condensation of the vapors by cooling.	Eliminated. Not capable of treating large volumes of water within a reasonable time period.
		Evaporation	Change from the liquid to the gaseous state at a temperature below the boiling point.	Eliminated. Not effective at treating wastes containing dilute mixtures of contaminants.

TABLE 2-8 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-situ Treatment (cont.)	Ex-Situ Chemical Treatment (cont.)	Ion Exchange	Process in which toxic ions are removed from the aqueous phase by being exchanged with relatively harmless ions held by electrostatic forces to a specifically formulated resin.	Potentially applicable as a treatment option for groundwater contaminated with arsenic.
		Chemical Oxidation	Use of oxidizing agents, such as chlorine or potassium permanganate, to chemically increase the oxidation state of materials in order to reduce their toxicity or solubility.	Potentially applicable as a treatment option for groundwater contaminated with inorganic and/or organic contaminants.
		UV Oxidation	Use of ozone and/or hydrogen peroxide, with UV light as catalyst, to oxidize organic materials in order to reduce their toxicity. If carried out completely, this destructive process will yield final products of CO_2, H_2O, and salts.	Potentially applicable.
		Neutralization	Use of acids or bases to counteract excessive pHs or adjust pH to the optimum level for a given treatment process.	Potentially applicable. Could be used as a pre-treatment process to improve the performance of an ex-situ treatment process.
		Precipitation / Coprecipitation	Use of chemicals to transform dissolved contaminants into an insoluble solid. In coprecipitation, the target contaminant may be dissolved or in a colloidal or suspended form.	Potentially applicable as a treatment option for groundwater contaminated with arsenic.
		Flocculation	Use of chemicals to neutralize surface charges and promote attraction of colloidal particles to facilitate settling.	Potentially applicable. Could be used as a pre-treatment process to improve the performance of an ex-situ treatment process.
		Dechlorination	Use of chemicals to remove chlorine from chlorinated compounds.	Potentially applicable for the treatment of groundwater contaminated with TCE or 1,2-DCA.
		Zero-Valent Iron	Iron is used as a reducing agent to enhance the rate of degradation of chlorinated organics in extracted water.	Potentially applicable for the treatment of groundwater contaminated with TCE or 1,2-DCA.

TABLE 2-8 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-situ Treatment (cont.)	Ex-Situ Chemical Treatment (cont.)	Fenton's Reagent	Iron-catalyzed hydrogen peroxide used to enhance oxidation, promote destruction of chlorinated organics.	Potentially applicable for the treatment of groundwater contaminated with TCE or 1,2-DCA.
	Ex-situ Biological Treatment	Aerobic Biodegredation	Suspended growth or fixed film process employing aeration and biomass recycle to decompose organic contaminants.	Potentially applicable for the treatment of organic site contaminants.
		Anaerobic Biodegredation	Suspended growth or fixed film process employing anaerobic bacteria to decompose organic contaminants in an oxygen-free environment.	Potentially applicable for the treatment of organic site contaminants.
Discharge	Beneficial Reuse	On-Site Re-Use	Recovered and treated potable-quality water used to water vegetation and ground cover.	Eliminated. Since most of site located outside of potential drinking water source area, remedial goals are likely to be less stringent than drinking water standards.
	Surface Discharge	Direct Discharge	Discharge of treated water to local stream or river.	Potentially applicable.
		Indirect Discharge	Discharge of treated water to a publicly owned treatment works (POTW).	Potentially applicable. Subject to adequate capacity at the local facility.
	Subsurface Discharge	Infiltration Gallery	Treated water redistributed into aquifer through a network of perforated pipes.	Potentially applicable. Would need to comply with 310 CMR 27.00.
		Deep Well Injection	This alternative uses injection wells to place treated or untreated liquid waste into geologic formations that have no potential to allow migration of contaminants into potential potable water aquifers.	Eliminated. Proximity of site to potential drinking water source area, and urban nature of surrounding areas, makes this option infeasible.
In-Situ Treatment	In-Situ Physical Treatment	Air Sparging with Soil-Vapor Extraction	Injection of air into groundwater to foster physical stripping of VOCs from the aqueous phase into the gas phase. The VOCs would rise through the vadose zone and soil column to be captured by a soil vapor extraction system.	Potentially applicable as an in-situ treatment option for groundwater contaminated with benzene, naphthalene, and/or TCE.

TABLE 2-8 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
In-Situ Treatment (cont.)	In-Situ Chemical Treatment	Permeable Reactive Barrier	These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators, sorbents, microbes, and others.	Potentially applicable as an in-situ treatment option for groundwater contaminated with arsenic.
		In-Situ Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potentially applicable as an in-situ treatment option for groundwater contaminated with benzene, TCE, and/or naphthalene.
	In-Situ Biological Treatment	Enhanced Bioremediation	A hydrogen peroxide or magnesium peroxide formulation is circulated through the contaminated ground water zone to increase the oxygen content of ground water and enhance the rate of aerobic biodegradation of organic contaminants by naturally occurring microbes.	Potentially applicable as an in-situ treatment option for groundwater contaminated with organic contaminants.
		Constructed Wetlands	Natural geochemical and biological processes that are inherent in an artificial wetland ecosystem are used to accumulate and remove metals and other contaminants from influent waters.	Eliminated. Contaminated groundwater discharges to wetlands that are already heavily contaminated with arsenic. Construction of new wetlands in groundwater contamination areas not feasible.
		Hydrogen Release Compound	A proprietary formulation of polylactate is injected into the groundwater, triggering the timed release of lactic acid that enhances anaerobic biodegradation of contaminants in groundwater.	Potentially applicable for the treatment of trichloroethene in groundwater.

Notes:

1. General response actions, remedial technologies, and process options for groundwater were adapted from Table 2-6.
2. Process options were retained or eliminated based on an evaluation of their technical implementability given the contaminant types and concentrations in groundwater, and other relevant site characteristics.

TABLE 2-9
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
No Action	No Action	No Action	No active remediation conducted to address sediment contamination.	Retained for baseline comparison purposes in accordance with the National Contingency Plan.
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as excavation or residential development could be restricted under property deeds.	Potentially applicable.
	Access Restrictions	Fencing/Signage	Physically restrict access to contaminated sediments by constructing a fence around contaminated areas and posting warning signs.	Potentially applicable.
	Monitoring	Sediment Sampling	Periodic sampling and analysis of sediment to assess contaminant fate and transport, and natural degradation of contaminants.	Potentially applicable.
	Natural Recovery	Monitored Natural Recovery	Natural, ongoing biological, chemical, or physical processes are relied upon to reduce risks by reducing the toxicity or bioavailability of contaminants in sediment.	Potentially applicable.
		Enhanced Natural Recovery	A thin layer of clean material is added to the contaminated sediment surface to accelerate the recovery process.	Potentially applicable.
Containment	Horizontal Barriers	Subaqueous Cap	Clean material is placed over contaminated sediment to physically and chemically isolate contaminants from the aquatic environment. Cap design could also include geotextiles, liners, or other permeable or impermeable elements.	Potentially applicable.
	Vertical Barriers	Silt Curtain/Silt Screen	Silt curtains and silt screens are flexible barriers that hang down from the water surface, supported by floats, and are ballasted along the bottom of the waterway to provide a vertical barrier that will prevent the migration of contaminants that are mobilized or resuspended by the dredging process.	Potentially applicable. Could be used to prevent contaminant migration during dredging operations or could function as part of a sediment retention system (see below).

TABLE 2-9 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Containment (cont.)	Surface Water Flow Control	Sediment Retention	Sediment retention would involve the use of surface water flow controls such as dikes, spillways, and plunge pools to mitigate the transport of suspended sediment. Periodic maintenance (i.e. removal of accumulated sediment) would be performed to ensure effectiveness.	Potentially applicable. Sediment retention technologies could be used to control flow patterns so that suspended sediment is able to be prevented from migrating with the flow of surface water.
		Stormwater Bypass	A stormwater bypass system would be constructed that would re-route surface water flow patterns around areas containing contaminated sediments during periods of high flow.	Potentially applicable. A storm water bypass system could reduce or eliminate the additional sediment transport that currently occurs during storm events.
Removal	Dredging	Mechanical Dredging	Mechanical dredging equipment (clamshell, backhoe, dragline, or similar device) is used to remove contaminated material from saturated zones or from areas of submerged sediment.	Potentially applicable.
		Hydraulic Dredging	Hydraulic dredging involves the use of pumps to remove sediment in a slurry phase. The slurry is typically pumped to a shore location where treatment of the slurry is performed to increase the percentage of solids. The remaining liquid is treated prior to discharge.	Potentially applicable.
	Excavation	Mechanical Excavation	Mechanical excavation could be used to remove unsaturated sediment or sediment that is located within reach of a shoreline that is acceptable to excavation equipment.	Potentially applicable in certain portions of the site.
Treatment	Immobilization	Solidification / Stabilization	Soil mixing equipment used to mix reagents with contaminated sediment to physically and/or chemically decrease the mobility of contaminants. Potential reagents include cement, pozzolanic material, thermoplastics, polymers and asphalt.	Potentially applicable. Treatment of contaminated sediment by solidification/stabilization would be performed ex-situ.
	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment would be done ex situ.	Eliminated. Not effective at treating sediments contaminated with arsenic.

TABLE 2-9 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Treatment (cont.)	Thermal Treatment (cont.)	Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment would be done ex situ.	Eliminated. Not effective at treating sediments contaminated with arsenic.
		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment may be done in situ or ex situ.	Eliminated. Emerging technology, not yet proven at full scale to be an effective treatment method for sediments contaminated with arsenic.
		Thermal Desorption	Volatile and semi-volatile compounds are separated from sediments by heating the sediment to temperatures ranging from 90 to 540 degrees Celsius.	Eliminated. Not effective at treating sediments contaminated with arsenic.
	Physical Treatment	Dewatering	Dewatering involves the physical separation of free liquids from excavated saturated sediment material. Dewatering could be accomplished passively or through the use of mechanical processes.	Potentially applicable. Dewatering would be a necessary pre-treatment process to improve the performance of most ex-situ sediment treatment technologies.
		Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	Eliminated. Not effective at treating sediments contaminated with arsenic.
		Physical Separation	An ex-situ process using gravity, magnetic, sieving, or physical separation techniques. Typically used to remove oversized material and debris to produce an acceptable feed material for subsequent handling and/or treatment.	Potentially applicable. Could be used as a pre-treatment process to improve the performance of a downstream treatment process.
		Electrical Separation	Electrochemical and electrokinetic processes are used to desorb, and then remove, metals and polar organics from soils, sediments, or sludges. Primarily a separation and removal technique.	Eliminated. Less effective at treating wastes with high moisture content.

TABLE 2-9 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Treatment (cont.)	Chemical Treatment	Acid Extraction	Contaminated sediment and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use.	Potentially applicable.
		Chemical Reduction / Oxidation	Reduction / oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Eliminated. Technology still emerging for treatment of sediment.
	Biological Treatment	Enhanced Bioremediation	Naturally occurring microbes are stimulated by circulating water-based solutions through contaminated soils to enhance in-situ biodegradation of organic contaminants or immobilize inorganic contaminants.	Eliminated. Not effective at removing inorganic contaminants from sediments.
		Land Farming	Excavated contaminated sediment is applied into lined beds and periodically turned over or tilled to aerate the waste.	Eliminated. Not effective at treating sediments contaminated with arsenic.
		Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic.	Potentially applicable. Retained as a treatment technology in areas where sediment contamination is concentrated near the ground surface.
Disposal	On-Site Disposal	Open-Water Disposal	Disposal of contaminated sediment at the bottom of a waterway, and capping of sediment to isolate contaminants from the environment.	Eliminated. Not feasible at this site.
		Consolidation and Capping	Consolidation and on-site disposal of contaminated sediment at a specially-constructed on-site landfill that includes a bottom liner for leachate collection and a low permeability cover to prevent the infiltration of precipitation.	Eliminated. Limited space available to construct landfill with capacity to handle anticipated volume of sediment.
		On-Site Reuse	Reuse of treated sediment as fill or backfill at an on-site location(s).	Potentially applicable.

TABLE 2-9 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR CONTAMINATED SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE OPTIONS	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS
Disposal (cont.)	Off-Site Disposal	Commercial Landfill	Disposal of contaminated sediment at an off-site, RCRA-compliant disposal facility. Sediment would likely require pre-treatment prior to disposal to reduce moisture content.	Potentially applicable.

Notes:

1. General response actions, remedial technologies, and process options for sediment were adapted from Table 2-6.
2. Process options were retained or eliminated based on an evaluation of their technical implementability given the contaminant types and concentrations in sediment, and other relevant site characteristics.

TABLE 2-10
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
FOR CONTAMINATED SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
No Action	No Action	No Action	No active remediation conducted to address surface water contamination.	Retained for baseline comparison purposes in accordance with the National Contingency Plan.
Limited Action	Institutional Controls	Deed Restrictions	Administrative action used to restrict future site activities on individual properties. Activities such as groundwater extraction/use or residential development could be restricted under property deeds.	Eliminated. Would not protect the benthic invertebrate community.
	Monitoring and Provide Alternate Habitat	Surface Water Sampling	Periodic sampling and analysis of groundwater to assess contaminant leaching and migration. Alternate habitat would provide suitable replacement habitat for impacted invertebrate community	Potentially applicable.
	Natural Attenuation	Monitored Natural Attenuation	Natural subsurface biological, chemical, or physical processes attenuate dissolved organics and inorganics, and limit migration of some contaminants.	Potentially applicable.
Containment	Horizontal Barriers	Impermeable Cap	Impermeable liner / multi-media cover over the bottom of the HBHA Pond to prevent groundwater discharge into surface water.	Eliminated. Would cause contaminated groundwater plume to discharge into lower portions of the HBHA.
	Horizontal Barriers	Permeable Cap	Permeable liner / multi-media cover over the bottom of the HBHA Pond to limit groundwater discharge into surface water.	Eliminated. Would not prevent the fallow and discharge of contaminated groundwater to surface water and would not protect the benthic invertebrate community.
	Hydraulic Containment	Extraction Wells	Configuration of extraction points in the groundwater discharge zone to capture flow and prevent containment migration.	Eliminated. Technically impractical to effectively extract only the hypolimnion. Extraction will likely increase discharge rate of contaminated groundwater further impacting sediments and the benthic community.

TABLE 2-10 (cont.)
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
FOR CONTAMINATED SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS
PAGE 2 OF 2

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Ex-Situ Treatment	Ex-Situ Physical Treatment	All ex-situ physical treatment processes (similar to groundwater processes explained in Table 2-8)	Multiple treatment process options to remove or destroy benzene and arsenic. (These are the same process as described for ex-situ groundwater treatment.)	Eliminated. This would require extraction of only the hypolimnion (see above).
	Ex-Situ Chemical Treatment	All ex-situ chemical treatment processes (similar to groundwater processes explained in Table 2-8)	Multiple treatment process options to remove or destroy benzene and arsenic. (These are the same process as described for ex-situ groundwater treatment.)	Eliminated. This would require extraction of only the hypolimnion (see above).
	Ex-Situ Biological Treatment	Aerobic Biodegredation	Suspended growth or fixed film process employing aeration and biomass recycle to decompose organic contaminants.	Eliminated. This would require extraction of only the hypolimnion (see above).
		Anaerobic Biodegredation	Suspended growth or fixed film process employing anaerobic bacteria to decompose organic contaminants in an oxygen-free environment.	Eliminated. This would require extraction of only the hypolimnion (see above).
In-Situ Treatment	In-Situ Biological Treatment	Enhanced Bioremediation	A hydrogen peroxide or magnesium peroxide formulation is circulated through the contaminated ground water zone to increase the oxygen content of ground water and enhance the rate of aerobic biodegradation of organic contaminants by naturally occurring microbes.	Eliminated. Mass of chemicals required to overcome dilution factors may be inefficient and result in overdosing which may adversely affect water quality of hyperlimnion. May not be effective for inorganic contaminants.
	In-Situ Chemical Treatment	In-Situ Oxidation /Aeration	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidation may also promote biodegradation. Volatilization may be the dominant process removing VOCs from surface water.	Eliminated. Volatilization will cause the uncontrolled release and transfer of VOCs from surface water to air.

Notes:
1. General response actions, remedial technologies, and process options for surface water were adapted from Table 2-6.
2. Process options were retained or eliminated based on an evaluation of their technical implementability given the contaminant types and concentrations in surface water, and other relevant site characteristics.

TABLE 2-11
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
No Action	No Action	Not Applicable	Would not achieve remedial objectives.	No off-site actions required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain
Limited Action	Institutional Controls	Deed Restrictions Local Ordinances	Would achieve remedial action objectives for subsurface soil by imposing restrictions that prevent direct contact with contaminated soil. Would not achieve remedial objectives for surface (accessible) soil without other actions. No human health or environmental impacts from implementation. Reliable to the extent that restrictions or ordinances can be enforced.	Deed restrictions and local ordinances would require legal and/or political actions from others. No treatment, storage, or disposal involved. Services readily available to implement institutional controls.	Capital: Low O&M: Low	Retain
	Monitoring	Soil Sampling	Would not achieve remedial objectives without other actions. Very low potential for impacts to human health and environment during implementation, so long as proper decontamination procedures and personal protective equipment (PPE) are utilized during soil sampling. Reliable process for the evaluation of contaminant migration trends and to monitor the progress of remediation or natural attenuation.	No off-site actions required. No treatment, storage, or disposal involved. Equipment and labor readily available from several sources.	Capital: None O&M: Medium	Retain
	Natural Attenuation	Monitored Natural Attenuation	Would achieve remedial objectives for the volume of contaminated soil present at the site. Contaminant reduction time frame would be long. No impacts to human health or environment during implementation. Reliable process.	No off-site actions required. No treatment, storage, or disposal services required. Skilled labor, equipment, and supplies needed to monitor site conditions during natural attenuation readily available.	Capital: None O&M: Medium	Eliminate
Containment	Horizontal Barriers	Impermeable Cap	Would achieve remedial objectives by preventing direct contact with contaminated soils. No adverse impacts during construction or implementation beyond those typical of any earth-moving construction activity. Reliable technology when implemented with an adequate O&M plan.	No off-site actions required. No treatment, storage, or disposal involved. Equipment, labor, and services for implementation readily available from several sources.	Capital: Medium O&M: Medium	Eliminate
		Permeable Cover	Would achieve remedial objectives by preventing direct contact with contaminated soils. No adverse impacts during construction or implementation beyond those typical of any earth-moving construction activity. Reliable technology when implemented with an adequate O&M plan.	No off-site actions required. No treatment, storage, or disposal involved. Equipment, labor, and services for implementation readily available from several sources.	Capital: Low/Med O&M: Medium	Retain
Removal	Excavation	Mechanical Excavation	Would achieve remedial objectives by removing all soil with concentrations exceeding remedial goals. No adverse impacts during implementation beyond those typical of any earth-moving construction activity. Decontamination and health and safety (H&S) procedures would be utilized to prevent the spread of contamination during excavation. Very reliable process for the elimination of arsenic contamination in soil at the site.	No off-site actions required. Adequate on-site capacity available for temporary storage of excavated material. Location to be determined. No treatment or disposal involved. Conventional construction process that is easily implemented with equipment and services that are readily available from several sources. Excavation of soil located below the water table would present technical implementability issues.	Capital: Low O&M: None <u>Note</u>: Includes cost of excavating only. Transport, treatment, or disposal of soil not included.	Retain
Treatment	Immobilization	Solidification/ Stabilization (S/S)	Would not achieve remedial objectives for contaminated soil present at the site since no reduction in contaminant volume would be achieved on direct contact risks would remain. Potential impacts to human health and the environment from excavation of contaminated soil and implementation of S/S process could be mitigated using proper decontamination and H&S procedures. Reliable process for the treatment of arsenic-contaminated soil.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated soil. Equipment and skilled labor required for treatment readily available from several vendors.	Capital: Medium O&M: None	Retain
	Physical Treatment	Physical Separation	Could handle the anticipated volume of contaminated soil at the site, but process would not meet remediation goals without another treatment process. Potential impacts to human health and the environment from excavation of contaminated soil and implementation of physical separation process could be mitigated using proper decontamination and H&S procedures. Process is proven and reliable, but will not remove contaminants from soil. Potentially useful as a pre-treatment process.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated soil. Equipment and skilled labor required for treatment readily available from several vendors.	Capital: Medium O&M: None	Eliminate

TABLE 2-11 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
Treatment (cont.)	Chemical Treatment	Acid Extraction	Could achieve remedial objectives for the volume of contaminated soil present at the site. Potential impacts to human health and the environment from excavation of contaminated soil and implementation of the acid extraction process could be mitigated using proper decontamination and H&S procedures. Has been shown to be a reliable process for the treatment of arsenic-contaminated soil. A treatability study would be required to verify the effectiveness of this process on the soil types present at the site.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated soil. Equipment and skilled labor required for treatment available from at least 2-3 vendors.	Capital: High O&M: None	Eliminate
		Chemical Reduction	Ability to achieve remedial objectives for contaminated soil at the site questionable. Potential impacts to human health and the environment from excavation of contaminated soil and implementation of the chemical reduction treatment process could be mitigated using proper decontamination and H&S procedures. Limited information available on the reliability of this technology to treat arsenic-contaminated soil. Treatability study would be required.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities may not be available to handle anticipated volume of contaminated soil. Equipment and skilled labor required for treatment may be difficult to obtain. Very few vendors offer this technology for the treatment of soil.	Capital: High O&M: None	Eliminate
Disposal	On-Site Disposal	Soil Consolidation and Capping	Feasible for anticipated volume of contaminated soil. Would achieve remedial objectives for soil by preventing direct contact with contaminants by isolating them beneath a cap. Potential impacts to human health and the environment from excavation of contaminated soil and construction of a cap could be mitigated using proper decontamination and H&S procedures. Reliable process if an adequate O&M plan is implemented.	No off-site actions required. Adequate capacity for the consolidation of soil would be available on site. The equipment and labor necessary to implement this process would be readily available from several sources. On-site consolidation and capping contamiated soil would impose restrictions on future land use scenarios.	Capital: Low O&M: High	Retain
	On-Site Disposal (cont)	On-Site Reuse	Feasible for anticipated volume of contaminated soil. Effective after achievement of remediation goals using a soil treatment technology. Potential impacts to human health and the environment from excavation of contaminated soil, treatment, and on-site reuse could be mitigated using proper decontamination and H&S procedures. Reliable method for on-site disposal of treated material provided that a feasible location can be identified on the site.	No off-site actions required. Space/capacity for on-site reuse (disposal) of treated soil would be available on site. Equipment and skilled labor readily available to implement this technology. On-site reuse of treated soil would impose restrictions on future land use scenarios.	Capital: Low O&M: High	Retain
	Off-Site Disposal	Commercial Landfill	Feasible for anticipated volume of contaminated soil. Remedial objectives would be achieved since direct contact risks would be eliminated. Potential impacts to human health and the environment from excavation of contaminated soil and transportation to the disposal facility could be mitigated using proper decontamination and H&S procedures. Proven and reliable for site contaminants.	Permits for off-site landfill disposal could easily be obtained. Off-site disposal capacity for the anticipated volume of contaminated soil would be available. Equipment and skilled labor readily available to implement this technology.	Capital: High O&M: None	Retain

Notes:

1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated soil and meeting the preliminary remediation goals (Table 2-5).
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for off-site actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical or administrative implementability concerns.
3. Cost plays a limited role in the screening of process options. Relative capital and operations and maintenance (O&M) costs are used at this stage rather than detailed cost estimates. Cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type.

TABLE 2-12
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
No Action	No Action	Not Applicable	Would not achieve remedial objectives.	No off-site actions required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain
Limited Action	Institutional Controls	Deed Restrictions Local Ordinances	Would not achieve remedial objectives without other actions. No human health or environmental impacts from implementation. Reliable to the extent that restrictions can be enforced.	Deed restrictions and local ordinances would require legal and/or political actions from others. No treatment, storage, or disposal involved. Services readily available to implement institutional controls.	Capital: Low O&M: Low	Retain
	Monitoring	Groundwater Sampling	Would not achieve remedial objectives without other actions. Very low potential for impacts to human health and environment during implementation, provided that adequate decontamination and health and safety (H&S) procedures are utilized during groundwater sampling. Reliable process for the evaluation of contaminant migration trends and to monitor the progress of remediation or natural attenuation.	No off-site actions required. No treatment, storage, or disposal involved. Equipment and skilled labor readily available from several sources.	Capital: None O&M: Medium	Retain
	Natural Attenuation	Monitored Natural Attenuation	Would achieve remedial objectives for groundwater, but time frames would be very long. No human health or environmental impacts would result from implementation. Reliable process for the remediation of groundwater provided that there are no continuing sources of contamination. However, remedial time frames would be very long and institutional controls would be necessary to prevent exposures during the remediation period.	No off-site actions required. No off-site treatment, storage, or disposal involved. Equipment and skilled labor readily available to evaluate the progress of natural attenuation.	Capital: None O&M: Medium	Retain
Containment	Horizontal Containment	Low Permeability Cap	Would not achieve remedial objectives without other actions. Potential impacts to human health and the environment from the construction of a low permeability cap could be mitigated using proper decontamination and H&S procedures. Reliable technology to reduce the infiltration of rainwater through contaminated soils that might enable leaching of contaminants into groundwater. No treatment employed.	No off-site actions required. No treatment, storage, or disposal involved. Equipment and skilled labor for construction readily available from several sources.	Capital: Medium O&M: Medium	Eliminate
		Permeable Cover	Would not achieve remedial objectives without other actions. Potential impacts to human health and the environment from the construction of a permeable cover could be mitigated using proper decontamination and H&S procedures. Not a reliable technology to reduce water infiltration through contaminated soils. Leaching, if occurring, would not be reduced through the construction of a permeable cover.	No off-site actions required. No treatment, storage, or disposal involved. Equipment and skilled labor for construction readily available from several sources.	Capital: Low O&M Medium	Retain
	Hydraulic Containment	Vertical Extraction Wells	Would not achieve remedial objectives without other actions (i.e. treatment) Potential impacts to human health and the environment from the construction of wells or monitoring of containment system could be mitigated using proper decontamination and H&S procedures. Reliable process for hydraulic containment. Aquifer test or additional evaluation of site hydrogeology may be required to properly design.	No off-site actions required. No treatment, storage or disposal involved. Equipment and skilled labor available from several sources.	Capital: Medium O&M: High	Retain
Collection	Extraction	Vertical Extraction Wells	Would not achieve remedial objectives without other actions (i.e. treatment). Potential impacts to human health and the environment from the construction of wells could be mitigated using proper decontamination and H&S procedures. Reliable process for groundwater extraction. Aquifer test or additional evaluation of site hydrogeology may be required to properly design.	No off-site actions required. No treatment, storage or disposal involved. Equipment and skilled labor available from several sources.	Capital: High O&M: None	Retain
		Collection Trench	Would not achieve remedial objectives without other actions (i.e. treatment) Potential impacts to human health and the environment from the construction of trench(es) could be mitigated using proper decontamination and H&S procedures. Less reliable than extraction wells, effectiveness more subject to site-specific characteristics.	No off-site actions required. No treatment, storage or disposal involved. Equipment and skilled labor available from several sources.	Capital: High O&M: None	Eliminate
Ex-Situ Treatment	Ex-Situ Physical Treatment	Equalization	Would not achieve remedial objectives without other actions (i.e. treatment). Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable pre-treatment process that enables homogenization of influent groundwater to maximize the efficiency of a subsequent treatment process.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: Medium	Retain

TABLE 2-12 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
Ex-Situ Treatment (cont.)	Ex-Situ Physical Treatment (cont.)	Dewatering	Would not achieve remedial objectives without other actions (i.e. treatment) Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable pre-treatment process that reduces the moisture content of sludges that might result from a filtration process. Dewatering would be necessary to dry out sludges so that they could be disposed of at an off-site facility.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate and sludge generation rate. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: Medium	Retain
		Sedimentation	Not likely to achieve remedial objectives without further treatment. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable pre-treatment process that would decrease the concentration of suspended solids in the influent waste stream, increasing the efficiency of a subsequent treatment process.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: None	Retain
		Filtration	Could achieve remedial objectives for the removal of inorganic contaminants from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process, has been proven to be effective at removing inorganic contaminants from aqueous waste streams to improve the performance of a downstream treatment process. Could be used as pre-treatment process to remove inorganic constituents from aqueous waste stream prior to a treatment process designed to remove organic contaminants.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: None	Retain as pre-treatment process as needed.
		Nanofiltration	Could achieve remedial objectives for the removal of arsenic from extracted groundwater. Treatability study would be conducted to verify effectiveness for site-specific groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Nanofiltration has been shown to reduce arsenic (V) concentrations in aqueous waste streams by 95% at the pilot scale. Treatment less reliable for removing arsenic (III). No full scale applications identified.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: None	Eliminate
		Reverse Osmosis	Could achieve remedial objectives for the removal of arsenic from extracted groundwater. Treatability study would be conducted to verify effectiveness for site-specific groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. 99 percent arsenic removal observed in one full scale application. Greater than 95% removal of arsenic (V) observed in pilot studies using reverse osmosis; less effective removing arsenic (III). Very limited full scale applications of this technology.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: None	Eliminate
		Air Stripping	Could achieve remedial objectives for the removal of benzene/toluene or TCE from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Very reliable and proven technology.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: Medium	Eliminate
		Adsorption	Could achieve remedial objectives for the removal of organic or inorganic groundwater contaminants, depending upon the adsorption media selected. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Adsorption using activated carbon is a reliable and proven technology for the removal of VOCs. Activated carbon has also been used to remove arsenic from an aqueous stream, but regeneration of carbon for arsenic treatment can be problematic. Activated alumina is the sorbent that is most commonly used to treat arsenic, and has been used reliably in several full-scale applications for this purpose.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: High	Retain

TABLE 2-12 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS
OPTIONS FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
Ex-Situ Treatment (cont.)	Ex-Situ Chemical Treatment	Ion Exchange	Could achieve remedial objectives for the removal of arsenic from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process that has been used in at least seven full-scale applications to treat arsenic-contaminated water.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: High	Eliminate
		Chemical Oxidation	Ability to achieve remedial objectives uncertain. Chemical oxidation would be used as part of a treatment train to change the chemical form of arsenic as it enters a treatment system, which will improve the performance of a downstream treatment process. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process, used in many wastewater treatment processes. Would not be relied upon to decrease arsenic concentrations without another treatment process.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Retain as pre-treatment process as needed
		Neutralization	Would not achieve remedial objectives. Would be used as pre-treatment process to improve the performance of a downstream treatment process. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process, used in many wastewater treatment processes. Would not be relied upon to decrease arsenic concentrations without another treatment process.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Eliminate
		Precipitation/ Coprecipitation	Could achieve remedial objectives for the removal of arsenic from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process for the removal of arsenic from extracted groundwater. Precipitation/coprecipitation has been used at full-scale in at least 45 projects to treat water contaminated with arsenic.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Retain as representative ex-situ treatment option for arsenic
		Flocculation	Ability to achieve remedial objectives uncertain. Flocculation would be used as a pre-treatment process to improve the performance of a downstream treatment process. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process, used in many wastewater treatment processes. Would not be relied upon to decrease arsenic concentrations without another treatment process.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Eliminate
		Dechlorination	Could achieve remedial objectives for the removal of TCE from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Eliminate
		Zero-Valent Iron	Could achieve remedial objectives for the removal of arsenic from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process for the removal of arsenic from extracted groundwater. Zero-valent iron has been used at full-scale projects to treat water contaminated with arsenic.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Eliminate
		Fenton's Reagent	Could achieve remedial objectives for the removal of organics from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process for the removal/destruction of organics from extracted groundwater. .	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Medium	Eliminate
	Ex-Situ Biological Treatment	Aerobic Biodegradation	Could achieve remedial objectives for the removal of organics from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process for the removal/destruction of organics from extracted groundwater. .	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: Medium	Eliminate

TABLE 2-12 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
Ex-Situ Treatment (cont.)	Ex-Situ Biological Treatment (cont.)	Anaerobic Biodegradation	Could achieve remedial objectives for the removal of organics from extracted groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable treatment process for the removal/destruction of organics from extracted groundwater.	No off-site actions required. Treatment capacity would be available to implement this technology given the assumed ex-situ treatment system flowrate. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: Medium	Eliminate
Discharge	Surface Discharge	Direct Discharge	Would not achieve remedial objectives. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process, used in many wastewater treatment processes. Would not be relied upon to decrease arsenic or organic contaminant concentrations without another treatment process.	Permits to discharge water to a surface water would not likely be granted without pretreatment. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: Low	Eliminate
		Indirect Discharge	The volume of water that is likely to be discharged to the POTW under an ex-situ treatment (pump and treat) scenario is likely to be too large to be handled by the existing wastewater treatment system. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process for the discharge of treated water.	Permits to discharge treated water to a POTW would not likely be granted since the anticipated volume of water that would be discharged to the is likely to overwhelm the capacity of the facility. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: High	Eliminate
	Subsurface Discharge	Infiltration Gallery	The volume of water that is likely to be discharged into an infiltration gallery under an ex-situ treatment (pump and treat) scenario would be very large. Additional investigation would need to be conducted to determine if the subsurface at the site could handle this volume of water without undesirable impacts to local groundwater levels or flow directions. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable process for the discharge of treated water under many circumstances.	No off-site actions required. Additional investigation would be needed to determine if direct discharge to an infiltration gallery would be implementable at the site. Equipment and skilled workers would be available to implement this technology.	Capital: Medium O&M: Low	Eliminate
In-Situ Treatment	In-Situ Physical Treatment	Air Sparging/Soil Vapor Extraction	Could achieve remedial objectives for VOCs in groundwater, provided that air sparge points could be located in a manner that permits distribution of air throughout the contaminated area. Would not remove arsenic contamination from groundwater. Previous attempts at air sparging on the site have created potential human health risks that forced the abandonment of the treatment system. Reliable process for the treatment of VOCs in groundwater where site-specific conditions are amenable to the distribution of air to the subsurface.	No off-site actions required. Treatment services would be available to implement this technology. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: Low	Retain
		Permeable Reactive Barrier (PRB)	Achievement of remedial objectives for arsenic in groundwater would be dependent upon the location of the barrier. A barrier installed downgradient from the locations where future risks were identified would not achieve remedial objectives in the impacted area. A PRB would not achieve remedial objectives for organic contaminants in groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures during construction. PRBs have been proven as a reliable technology for the treatment of arsenic in groundwater when zero-valent iron is utilized as a treatment medium.	No off-site actions required. Treatment services would be available to implement this technology. Equipment and skilled workers would be available to implement this technology.	Capital: Low O&M: High	Retain
	In-Situ Chemical Treatment	In-Situ Chemical Oxidation (ISCO)	ISCO could achieve remedial objectives for organic contaminants (TCE, benzene, toluene) provided that the chemical oxidant could be delivered to the contaminated area effectively. ISCO would not achieve remedial objectives for arsenic in groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. ISCO is a reliable technology for the treatment of organic contaminants in groundwater, provided that site-specific subsurface conditions are amenable to the distribution of the oxidant throughout the area of contamination.	No off-site actions required. Treatment services would be available to implement this technology. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: High	Eliminate

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
In-Situ Treatment (cont.)	In-Situ Biological Treatment	Enhanced Bioremediation	Could achieve remedial objectives for organic contaminants (TCE, benzene, toluene) provided that the nutrients or oxygen could be delivered to the contaminated area effectively. Enhanced bioremediation would not achieve remedial objectives for arsenic in groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Enhanced bioremediation is a reliable technology for the treatment of organic contaminants in groundwater, provided that site-specific subsurface conditions are amenable to the distribution of nutrients and/or oxygen throughout the area of contamination.	No off-site actions required. Treatment services would be available to implement this technology. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: High	Retain
		Hydrogen Release Compound (HRC)	Could achieve remedial objectives for organic contaminants (TCE, benzene, toluene) provided that the nutrients or chemical oxidant could be delivered to the contaminated area effectively. HRC may not achieve remedial objectives for arsenic in groundwater. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. HRC is a reliable technology primarily for the treatment of organic contaminants in groundwater, provided that site-specific subsurface conditions are amenable to the distribution of the oxidant throughout the area of contamination.	No off-site actions required. Treatment services would be available to implement this technology. Equipment and skilled workers would be available to implement this technology.	Capital: High O&M: High	Retain

Notes:

1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated groundwater and meeting the preliminary remediation goals (Table 2-5).
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for off-site actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical implementability concerns.
3. Cost plays a limited role in the screening of process options. Relative capital and operations and maintenance (O&M) costs are used at this stage rather than detailed cost estimates. Cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type.

TABLE 2-13
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[3]	COST[3]	CONCLUSION
No Action	No Action	Not Applicable	Would not achieve remedial objectives.	No off-site actions required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain
Limited Action	Institutional Controls	Deed Restrictions Local Ordinances	Would not achieve remedial objectives without other actions. No human health or environmental impacts from implementation. Reliable to the extent that restrictions can be enforced.	Deed restrictions and local ordinances would require legal and/or political actions from others. No treatment, storage, or disposal involved. Services readily available to implement institutional controls.	Capital: Low O&M: Low	Retain
	Access Restrictions	Fencing/Signage	Would not achieve remedial objectives without other actions. No human health or environmental impacts from implementation. Reliable to the extent that barriers are maintained and warnings are heeded.	No off-site actions required. No treatment, storage or disposal involved. Conventional construction, readily available skilled labor and services from several sources.	Capital: Medium O&M: Low	Retain
	Monitoring	Sediment Sampling	Would not achieve remedial objectives without other actions. Very low potential for impacts to human health and environment during implementation provided that proper decontamination procedures and adequate personal protective equipment are used during sampling. Reliable process for the evaluation of contaminant migration trends and to monitor the progress of remediation or recovery.	No off-site actions required. No treatment, storage, or disposal involved. Labor and services readily available from several sources.	Capital: None O&M: Medium	Retain
	Natural Recovery	Monitored Natural Recovery	Could achieve remedial objectives for the volume of contaminated sediment present at the site. No impacts to human health or environment during implementation. Reliable process, but contaminant reduction would be gradual, resulting in very long remedial time frames. Treatability investigation would be conducted to verify that adequate natural processes are present to achieve cleanup goals.	No off-site actions required. No treatment, storage, or disposal services required. Skilled labor, equipment, and supplies needed to monitor site conditions during recovery would be readily available.	Capital: Low O&M: Medium	Eliminate
Containment	Horizontal Barriers	Subaqueous Cap	Would achieve remedial objectives by preventing direct human contact with contaminated sediment and reducing the rate of contaminated sediment resuspension and migration. Potential adverse impacts to human health during construction could be mitigated through the use of proper decontamination and health and safety (H&S) procedures. Short-term adverse impacts to the environment would be unavoidable. Reliable technology when implemented with an adequate O&M plan.	No off-site actions required. No treatment, storage, or disposal involved. Materials, labor, and services for implementation available from several vendors. Specialization in underwater construction would be necessary, which would limit potential contractors.	Capital: Medium O&M: High	Retain
	Vertical Barriers	Silt Screen/Silt Curtain	Would not achieve remedial objectives without other actions. No adverse impacts to human health or the environment if utilized properly. Reliable technology to prevent downstream migration of contaminated sediment during sediment removal or cap placement activities.	No off-site actions required. No treatment, storage, or disposal involved. Equipment and services for implementation available from several sources.	Capital: Low O&M: None	Retain
	Surface Water Flow Control	Sediment Retention	Would not achieve treatment goals, but would achieve remedial action objective pertaining to limiting the mobility of contaminated sediment. Potential adverse impacts to human health during construction could be mitigated using proper decontamination and H&S procedures. Modification of surface water bodies would have impacts on the environment during implementation, but only in the short term. Should be a reliable method to limit the mobility of contaminated sediment that might be resuspended into the water column.	No off-site actions required. No treatment, storage, or disposal involved. Materials, labor, and services for implementation are available from several vendors.	Capital: Medium O&M: Medium	Retain

TABLE 2-13 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[3]	COST[3]	CONCLUSION
Containment (cont.)	Surface Water Flow Control (cont.)	Stormwater Bypass	Would not achieve treatment goals, but would achieve remedial action objective pertaining to limiting the mobility of contaminated sediment. Potential adverse impacts to human health during construction could be mitigated using proper decontamination and H&S procedures. Minimal impacts to the environment during construction/implementation. Would be a reliable method to prevent high flow conditions that have been shown to resuspend contaminated sediment into the water column.	No off-site actions required. No treatment, storage, or disposal involved. Materials, labor, and services for implementation are available from several vendors.	Capital: Medium O&M: Medium	Retain
Removal	Dredging	Mechanical Dredging	Would achieve remedial objectives by removing all sediment with concentrations of COCs exceeding their remedial goals. Potential adverse impacts to human health during implementation could be mitigated using proper decontamination and H&S procedures. Adverse short-term impacts to the environment would be unavoidable. Very reliable process for the removal of contaminated sediment under the right conditions.	No off-site actions required. Adequate on-site capacity available for temporary storage of dredged sediment (assuming no removal of HBHA Pond sediments). Location to be determined. No treatment or disposal involved. Commonly used process that is implemented using equipment and services that are readily available from several vendors.	Capital: High O&M: None	Eliminate
		Hydraulic Dredging	Would achieve remedial objectives by removing all sediment with concentrations of COCs exceeding their remedial goals. Potential adverse impacts to human health during implementation could be mitigated using proper decontamination and H&S procedures. Adverse short-term impacts to the environment would be unavoidable. Reliable process for the removal of contaminated sediment. Limited to "flowable" sediments, not capable of removing sediments containing large rocks or other debris. More effective than mechanical dredging at preventing sediment resuspension during removal.	No off-site actions required. Adequate on-site capacity available for temporary storage of dredged sediment (assuming no removal of HBHA Pond sediments). Location to be determined. No treatment or disposal involved. Equipment and services capable of performing hydraulic dredging projects are available, but in fewer number than either excavation or mechanical dredging.	Capital: High O&M: None	Retain for dredging in the HBHA Pond
	Excavation	Mechanical Excavation	Would achieve remedial objectives by removing all sediment with concentrations of COCs exceeding their remedial goals. Potential adverse impacts to human health during implementation could be mitigated using proper decontamination and H&S procedures. Adverse short-term impacts to the environment would be unavoidable. Very reliable process for the removal of contaminated sediment. Less effective than dredging for removal of submerged sediment or sediment that is not accessible from dry ground. Greater removal accuracy versus dredging technologies.	No off-site actions required. Adequate on-site capacity available for temporary storage of excavated sediment (assuming no removal of HBHA Pond sediments). Location to be determined. No treatment or disposal involved. Conventional construction process that is easily implemented with equipment and services that are readily available from several sources.	Capital: Medium O&M: None	Retain for sediment removal in areas that are accessible to excavation equipment
Treatment	Natural Recovery	Enhanced Natural Recovery	Could achieve remedial objectives for the volume of contaminated sediment present at the site. Potential adverse impacts to human health during implementation could be mitigated using proper decontamination and H&S procedures. Short-term impacts to the environment would be minimal. Could potentially increase contaminant reduction rates over those that would be expected under MNR. Treatability investigation would be conducted to verify that adequate natural processes are present to achieve cleanup goals and that enhanced natural recovery would be useful to accelerate contaminant reduction processes.	No off-site actions required. No treatment, storage, or disposal services required. Skilled labor, equipment, and supplies needed to place the thin-layer cover and monitor site conditions during recovery period would be available from several sources.	Capital: Medium O&M: Medium	Eliminate

TABLE 2-13 (cont.)
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[3]	COST[3]	CONCLUSION
Treatment (cont.)	Immobilization	Solidification/ Stabilization (S/S)	Could achieve remedial objectives for the volume of contaminated sediment present at the site (assuming no treatment of HBHA Pond sediment). Potential impacts to human health and the environment from dredging or excavation of contaminated sediment and implementation of S/S process could be mitigated using proper decontamination and H&S procedures. Very reliable process for the treatment of arsenic-contaminated sediment after it has been adequately dewatered.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated sediment (assuming no treatment of HBHA Pond sediments). Equipment and skilled labor required for treatment readily available from several vendors.	Capital: Medium O&M: None	Retain
	Physical Treatment	Dewatering	Would not achieve remedial objectives without another treatment process. Potential impacts to human health and the environment from the dewatering process could be mitigated using proper decontamination and H&S procedures. Very reliable process, but does not remove contaminants from sediment.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated sediment (assuming no treatment of HBHA Pond sediments). Equipment and skilled labor required for treatment readily available from several vendors.	Capital: Low O&M: None	Retain as pre-treatment process as needed.
		Physical Separation	Could handle the anticipated volume of contaminated sediment at the site (assuming no treatment of HBHA Pond sediment), but process would not meet remediation goals without another treatment process. Potential impacts to human health and the environment from the implementation of the physical separation process could be mitigated using proper decontamination and H&S procedures. Process is proven and reliable, but will not remove contaminants from sediment. Potentially useful as a pre-treatment process.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated sediment (assuming no treatment of HBHA Pond sediment). Equipment and skilled labor required for treatment readily available from several vendors.	Capital: Medium O&M: None	Eliminate
	Chemical Treatment	Acid Extraction	Could achieve remedial objectives for the volume of contaminated sediment present at the site, assuming no treatment of HBHA Pond sediments is undertaken. Potential impacts to human health and the environment from implementation of the acid extraction process could be mitigated using proper decontamination and H&S procedures. Has been shown to be a reliable process for the treatment of arsenic-contaminated soil. Less proven for treatment of sediment. Dewatering prior to treatment would be required. A treatability study would be required to verify the effectiveness of this process on the sediment present at the site.	No off-site actions required if treatment conducted on site. Permits for the transportation and off-site treatment of soil could be obtained. Adequate treatment services/facilities available to handle anticipated volume of contaminated sediment (assuming no treatment of HBHA Pond sediment). Equipment and skilled labor required for treatment available from at least 2-3 vendors.	Capital: High O&M: None	Eliminate
	Biological Treatment	Phytoremediation	May achieve remedial objectives for contaminated sediment at the site. Would not be effective for treatment of sediment in HBHA Pond. Minimal impacts to human health and the environment anticipated from phytoremediation. Less reliable than the other treatment technologies for the treatment of sediment contaminated with arsenic. Treatability study would be required.	No off-site actions required. Adequate treatment services/facilities may be available to handle anticipated volume of contaminated sediment (assuming no removal of HBHA Pond sediment). Equipment and skilled labor required for phytoremediation would be available.	Capital: Low O&M: Medium	Eliminate
Disposal	On-Site Disposal	On-Site Reuse	Feasible for anticipated volume of contaminated sediment, assuming no removal of HBHA Pond sediment. Effective after achievement of remediation goals using a sediment treatment technology. Potential impacts to human health and the environment during implementation could be mitigated using proper decontamination and H&S procedures. Reliable method for on-site disposal of treated material provided that an adequate operations and maintenance plan is implemented to ensure that the integrity of the cover system is maintained and that contaminants remain immobilized in the long term.	No off-site actions required. Space/capacity for on-site reuse (disposal) of treated sediment should be available on site, assuming no removal of HBHA Pond sediment. Equipment and skilled labor readily available to implement this technology. On-site reuse of treated sediment would impose restrictions on future land use scenarios.	Capital: Low O&M: High	Retain

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[3]	COST[3]	CONCLUSION
Disposal (cont.)	Off-Site Disposal	Commercial Landfill	Feasible for anticipated volume of contaminated soil, provided no removal of HBHA Pond sediment. Remedial objectives would be achieved. Potential impacts to human health and the environment from excavation of contaminated soil and transportation to the disposal facility could be mitigated using proper decontamination and H&S procedures. Proven and reliable for site contaminants.	Permits for transportation and off-site landfill disposal could easily be obtained. Off-site disposal capacity for the anticipated volume of contaminated soil would be available (assuming no removal of HBHA Pond sediment). Equipment and skilled labor readily available to implement this technology.	Capital: High O&M: Low	Retain

Notes:

1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated sediment and meeting the preliminary remediation goals (Table 2-5).
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for off-site actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical implementability concerns.
3. Cost plays a limited role in the screening of process options. Relative capital and operations and maintenance (O&M) costs are used at this stage rather than detailed cost estimates. Cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type.

TABLE 2-14
EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS
FOR SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]	CONCLUSION
No Action	No Action	Not Applicable	Would not achieve remedial objectives.	No off-site actions required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain
Limited Action	Monitoring & Provide Alternate Habitat	Surface Water Sampling	Would not achieve remedial objectives without other actions. Very low potential for impacts to human health and environment during implementation, provided that adequate decontamination and health and safety (H&S) procedures are utilized during surface water sampling. Reliable process for the evaluation of contaminant migration trends and to monitor the progress of remediation or natural attenuation.	Requires finding suitable alternate wetlands habitat within the Aberjona watershed and obtaining required permits. No treatment, storage, or disposal involved. Equipment and skilled labor readily available from several sources.	Capital: High O&M: Medium	Retain
	Natural Attenuation	Monitored Natural Attenuation	Would achieve remedial objectives for surface water, but time frames would be very long. No human health or environmental impacts would result from implementation. Reliable process for the remediation of surface water provided that there are no continuing sources of contamination (i.e. groundwater inputs). However, remedial time frames would be very long and institutional controls would be necessary to prevent exposures during the remediation period.	No off-site actions required. No off-site treatment, storage, or disposal involved. Equipment and skilled labor readily available to evaluate the progress of natural attenuation.	Capital: None O&M: Medium	Retain

Notes:

1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated surface water and meeting the preliminary remediation goals (Table 2-5).
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for off-site actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical implementability concerns.
3. Cost plays a limited role in the screening of process options. Relative capital and operations and maintenance (O&M) costs are used at this stage rather than detailed cost estimates. Cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type.

TABLE 3-1
SCREENING OF REMEDIAL ALTERNATIVES FOR SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

ALTERNATIVE TITLE	DESCRIPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]
No Action	See Section 3.2.1	A. Would not protect human health in the short term. B. Would not protect human health in the long term. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible.	Capital: None O&M: None
Monitoring with Institutional Controls	See Section 3.2.2	A. Would protect human health in the short term (no construction involved). B. Would protect human health in the long term by limiting or preventing on-site activities that might result in human exposure to contaminated soil. Would be less effective for contaminated surface soil, since it is more accessible than subsurface soil. Institutional controls are only effective to the extent that they can be adequately enforced. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible. Legal mechanisms may be used to impose institutional controls if resistance from a property owner is encountered.	Capital: Low O&M: Low
Permeable Cover and Monitoring with Institutional Controls	See Section 3.2.3	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls (excavation support, dust control), and decontamination procedures are utilized during constructions. B. Would protect human health in the long term since contaminated soil would be isolated from potential human contact by a layer of clean soil. Protection of human health would be contingent upon effectiveness of institutional controls to prevent damage to the cover. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible. This alternative would involve the excavation of approximately 1.5 feet of surface soil in currently vegetated areas, off-site disposal of this soil, and replacement of excavated soil with a permeable cover consisting of a geotextile and 1.5 feet of clean fill. Disposal capacity for the volume of soil would be readily available.	Capital: Medium O&M: Medium
Excavation and Off-Site Disposal	See Section 3.2.4	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls (excavation support, dust control), and decontamination procedures are utilized during implementation. B. Would protect human health in the long term since arsenic-contaminated soil (i.e. soil exceeding human health risk-based remediation goals) would be removed from the former Mishawum Lake bed. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible for surface soil. Excavation of surface soil would not be feasible where the arsenic-contaminated soil area (Figure 2-3a) extends below permanent structures. Excavation of subsurface soil (3-15 feet below ground surface) throughout the entire contaminated area would not be feasible due to the volume of soil that would need to be removed. B. Off-site disposal capacity would be available for surface soil.	Capital: High O&M: Low
Excavation, Treatment, and On-Site Reuse	See Section 3.2.5	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls (excavation support, dust control), and decontamination procedures are used during excavation and treatment of contaminated soil. B. Would protect human health in the long term since all arsenic-contaminated soil (i.e. soil exceeding human health risk-based remediation goals) would be removed from the former Mishawum Lake bed and would be treated to remove arsenic. Treated material that is reused on the Site would contain concentrations of arsenic that are less than the remediation goal for arsenic, which would eliminate the potential for future direct contact risks. C. Would reduce the toxicity, mobility, and volume of contaminants through treatment.	A. Technically feasible for surface soil. Excavation of surface soil would not be feasible where the arsenic-contaminated soil area (Figure 2-3a) extends below permanent structures. Treatability study would be performed to verify technical feasibility of acid extraction process. B. Physical separation and acid extraction equipment would be available to treat anticipated volume of contaminated surface soil. Volume of contaminated subsurface soil would be too large for excavation and treatment.	Capital: High O&M: Low

Notes:

1. The following are the criteria that are used to evaluate the effectiveness of a remedial alternative (RI/FS guidance Section 4.3.2.1; USEPA, October 1988). Protectiveness statements for this screening focused on the protection of human health, since human health risks are the driver for soil remediation in the former Mishawum Lake bed:
   A. Protects human health and the environment in short term (during construction and implementation period).
   B. Protects human health and the environment in long term (period after the remediation is complete).
   C. Reduces the toxicity, mobility, or volume of contaminants through treatment.
2. The following are the criteria that were used to evaluate the implementability of a remedial alternative (RI/FS guidance Section 4.3.2.2; USEPA, October 1988):
   A. Technical feasibility, i.e. ability to construct, reliably operate, and meet technology-specific regulations for process options until the remedial action is complete. Operation, maintenance, and monitoring of alternative also included.
   B. Administrative feasibility, i.e. ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services (including capacity).
3. The cost evaluation that was conducted for the alternatives screening included a comparative evaluation of costs between soil remedial alternatives.

TABLE 3-2
SCREENING OF REMEDIAL ALTERNATIVES FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

ALTERNATIVE TITLE	DESCRIPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]
No Action	See Section 3.3.1	A. Would protect human health in the short term (no construction involved). B. Would not protect human health in the long term without other measures. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible.	Capital: None O&M: None
Pond Intercept with Monitoring and Institutional Controls	See Section 3.3.2	A. Would protect human health in the short term (no construction involved). B. Would protect human health in the long term since institutional controls would be implemented to prevent future groundwater uses that might pose human health risks. No treatment or containment of groundwater would be performed under this alternative, and contaminated groundwater would not be prevented from discharging to the HBHA Pond. C. Toxicity, mobility, and volume of contaminants would not be reduced through treatment.	A. Technically feasible if implemented with a migration control technology in the HBHA Pond that prevents contaminated sediment transport from the Pond and includes periodic removal of contaminated sediment that accumulates in the Pond. B. Administratively feasible. Technical specialists readily available to monitor and evaluate chemical conditions in Pond that are required to prevent transport of sediments.	Capital: None O&M: Low
Plume Intercept by Groundwater Extraction, Treatment, and Discharge and Monitoring with Institutional Controls	See Section 3.3.3	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during construction and implementation of the groundwater treatment system. B. Would protect human health in the long term through the use of institutional controls to prevent future exposures to contaminated groundwater. Contaminant concentrations in groundwater would not be expected to decrease below remediation goals in the foreseeable future, but contaminated groundwater discharges to the HBHA Pond would be prevented. C. Toxicity, mobility, and volume of contaminants in groundwater would be reduced through groundwater extraction and treatment.	A. Technically feasible if installed at a location where the groundwater extraction well network will intercept groundwater before it discharges into the HBHA Pond. B. Administratively feasible.	Capital: High O&M: High
Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls	See Section 3.3.4	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during injection of treatment reagents, construction of reactive barrier, and collection/ analysis of groundwater samples. B. Would protect human health in the long term through the use of institutional controls to prevent future exposures to contaminated groundwater. Contaminant concentrations in groundwater would not be expected to decrease below remediation goals in the foreseeable future, but contaminated groundwater discharges to the HBHA Pond would be prevented. C. Would reduce the toxicity, mobility, and volume of contaminants through treatment.	A. Technically feasible. A treatability study would be performed to verify the technical feasibility of using enhanced bio-remediation to treat organic contaminants-of-concern given site-specific aquifer conditions. Construction techniques are available that would permit construction of a reactive barrier to depths up to those required to be effective at this site. Treatability investigations would be needed to verify the reliability of thePRB technology given the aquifer conditions present in the arsenic contamination area. B. Administratively feasible.	Capital: High O&M: Medium

Notes:

1. The following are the criteria that are used to evaluate the effectiveness of a remedial alternative (RI/FS guidance Section 4.3.2.1; USEPA, October 1988). Protectiveness statements for this screening focused on the protection of human health, since human health risks are the driver for groundwater remediation at this site.
   A. Protects human health and the environment in short term (during construction and implementation period).
   B. Protects human health and the environment in long term (period after the remediation is complete).
   C. Reduces the toxicity, mobility, or volume of contaminants through treatment.
2. The following are the criteria that were used to evaluate the implementability of a remedial alternative (RI/FS guidance Section 4.3.2.2; USEPA, October 1988):
   A. Technical feasibility, i.e. ability to construct, reliably operate, and meet technology-specific regulations for process options until the remedial action is complete. Operation, maintenance, and monitoring of alternative also included.
   B. Administrative feasibility, i.e. ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services (including capacity).
3. The cost evaluation that was conducted for the alternatives screening included a comparative evaluation of costs between groundwater remedial alternatives.

TABLE 3-3
SCREENING OF REMEDIAL ALTERNATIVES FOR SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

ALTERNATIVE TITLE	DESCRIPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]
No Action	See Section 3.4.1.1	A. Would protect human health and the environment in the short term (no construction involved). B. Would not protect human health or the environment in the long term. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible.	Capital: None O&M: None
Institutional Controls	See Section 3.4.1.2	A. Would protect human health and the environment in the short term (no construction involved). B. *Near-Shore Sediments*, *Deep Sediments*: Would protect human health in the long term by limiting or preventing on-site activities that might result in human exposure to contaminated sediment. Would be less effective for contaminated sediment located near the ground surface, since it would be accessible to trespassers. Institutional controls are only as effective to the extent that they can be adequately enforced. *HBHA Pond*: Would not prevent exposures to ecological receptors, therefore would not provide long-term protection of the environment. Would not prevent continued migration of contaminated sediments from the HBHA Pond to downstream depositional areas. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible. B. Administratively feasible. Legal mechanisms may be used to impose institutional controls if resistance from a property owner is encountered.	Capital: Low O&M: Low
Monitoring with Institutional Controls	See Section 3.4.1.3	A. Would protect human health in the short term (no construction involved). B. *Near-Shore Sediments*, *Deep Sediments*: Would protect human health in the long term through the implementation of institutional controls to limit or prevent access to sediments that might result in human exposures to contaminants. Monitoring without institutional controls would not provide long term protection of human health. *HBHA Pond*: Institutional controls would not provide long-term protection to ecological receptors. Selection of this alternative for the HBHA Pond would need to be accompanied by another technology in order to achieve the RAO for protection of the environment. Would not prevent continued migration of contaminated sediments from the HBHA Pond to downstream depositional areas. C. No reduction in the toxicity, mobility, or volume of contaminants through treatment.	A. Technically feasible at any on-site location. B. Administratively feasible. No treatment, storage, or disposal of contaminated sediment required.	Capital: Low O&M: Medium
Subaqueous Cap	See Section 3.4.1.4	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during construction. Some short-term impacts to the environment would result, but carefully selected cap materials should enable the re-establishment of any aquatic ecosystems that are impacted by the cap construction. B. *Near-Shore Sediments*: May not protect human health in near-shore sediment areas since placement of a sediment cap could render the interior portions of the wetlands more accessible to humans and potentially create additional human health risks. Portions of the near-shore sediment risk areas are either not submerged beneath surface water or are located in shallow portions of the river. *Deep Sediments*: Would not provide any additional protection of human health beyond that which would be provided by prohibitions on dredging in the deep sediments risk areas. Exposure to contaminated sediment while dredging would not be prevented by installing a subaqueous cap. *HBHA Pond*: A subaqueous cap in the HBHA Pond would isolate contaminated sediments from the overlying water column, preventing resuspension and downstream transport/deposition that might create future human health risks at downstream areas. The cap would also provide long-term protection to ecological receptors by providing a habitat for the re-establishment of aquatic ecosystems at the bottom of the Pond and isolating benthic communities from contaminants. C. No reduction in the toxicity, mobility, or volume of contaminants in sediment would be achieved through the implementation of this alternative. Surface water that is removed from the Pond during construction of the cap would be treated to remove contaminants prior to returning it to the environment.	A. Technically feasible, but construction of a cap over the existing HBHA Pond sediments would be technically challenging. Would not be reliable in HBHA Pond unless a groundwater treatment technology is utilized to prevent contaminated groundwater discharges to the Pond that could contaminate the cap materials. A long-term maintenance and monitoring program would need to be implemented to verify and ensure the long-term effectiveness of a subaqueous cap. B. Permits or approvals may be required to place fill material within wetland/floodplain areas. No treatment, storage, or disposal of contaminated sediment required.	Capital: Medium O&M: High
Stormwater Bypass and Sediment Retention with Partial Dredging and Providing Alternate Habitat (*HBHA Pond only*)	See Section 3.4.2.3	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during construction. Some short-term impacts to the environment would result due to dredging and construction within an aquatic habitat. B. Would provide long-term protection of human health and the environment in the southern portion of the HBHA Pond through the removal and off-site disposal of contaminated sediment. Additional long-term protection of human health would be provided through the construction of surface water controls designed to reduce or eliminate downstream migration of arsenic-contaminated sediment from the Pond, which will prevent further contamination of sediment in downstream areas that might be accessible to human and/or ecological receptors. Would provide long-term protection of the environment in the southern portion of the Pond through the removal and off-site disposal of contaminated sediment. Would not be protective of ecological receptors in the contaminated sediment retention portion of the Pond, but would achieve the RAO for protection of the environment through the creation of an alternate habitat (i.e. compensatory wetland) for ecological receptors impacted by contaminated sediments in the Pond. C. No reduction of the toxicity, mobility, or volume of contaminants in sediment would be achieved through the implementation of this alternative. Dewatering liquids that are generated from the pre-treatment of dredged sediment would be treated to remove contaminants prior to returning it to the environment.	A. Technically feasible. The northern portion of HBHA Pond would be utilized as a sediment retention basin under this alternative. Discharges of untreated groundwater to the HBHA Pond under this alternative will not impact its reliability. Contaminants that precipitate out of groundwater that discharges to the Pond would accumulate in sediments at the Pond bottom, and would be periodically dredged and disposed of at an off-site facility. B. Conventional construction equipment and techniques required to implement this alternative. These would be readily available. Adequate capacity for the off-site disposal of dredged sediment would be available.	Capital: High O&M: Medium

ALTERNATIVE TITLE	DESCRIPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]
Removal and Off-Site Disposal	See Section 3.4.1.5	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during removal and transport of sediment. Some short-term impacts to the environment would result from excavating/dredging of sediment. B. *Near-Shore Sediments*: Would protect human health in the long term since all near-shore sediment containing contaminants in excess of human health risk-based remediation goals would be removed from the site. Since the anticipated dredging/excavation areas are isolated locations that are relatively small, long-term impacts to aquatic communities are expected to be minimal. *Deep Sediments*: Would protect human health in the long term since all deep sediments (sediment cores) containing contaminants in excess of human health risk-based remediation goals would be removed from the site. Since the deep sediment contamination area is so large, impacts to the environment would be severe. *HBHA Pond*: Would protect human health in the long term since all contaminated sediments would be removed from the HBHA Pond and no longer able to resuspend into the water column and migrate downstream during storm events. Would protect the environment in the long term by removing contaminated sediment from the Pond so that ecological receptors are no longer exposed to contamination. Ecological impacts to the Pond that would result from sediment dredging would be significant. C. No reduction of the toxicity, mobility, or volume of contaminants in sediment would be achieved through the implementation of this alternative. Dewatering liquids that are generated from the pre-treatment of dredged sediment would be treated to remove contaminants prior to returning it to the environment.	A. Technically feasible. Would not be reliable in the HBHA Pond unless a groundwater treatment technology is utilized to prevent contaminated groundwater discharges to the Pond that would recontaminate Pond sediments. B. Adequate capacity would be available for the off-site disposal of sediment that would be removed from near-shore sediments in the Wells G&H Wetland and Cranberry Bog Conservation Area; and sediments in the HBHA Pond. Due to the large volume of deep sediments that would need to be removed to achieve RAOs for deep sediments, capacity for the off-site disposal of deep sediments would be difficult to obtain.	Capital: High O&M: Low
Removal, Treatment, and On-Site Reuse	See Section 3.4.1.6	A. Would protect human health in the short term provided that adequate health and safety measures (i.e. personal protective equipment), engineering controls, and decontamination procedures are utilized during removal, transport, and treatment of sediment. Some short-term impacts to the environment would result from excavating/dredging of sediment. B. Long-term protection of human health and the environment would be the same as described for Removal and Off-Site Disposal, since the same sediment areas would be impacted. The long-term effectiveness of this alternative would be dependent upon the ability of treatment processes to remove contaminants from sediment to levels below remediation goals. C. Toxicity, mobility, and volume of contaminants in sediment and dewatering liquids would be reduced through treatment.	A. Technical feasibility limited since treatment process has not been shown to be reliable for the treatment of sediment. Technical feasibility of acid extraction process would need to be verified through a treatability study prior to implementing the alternative. This alternative would not be reliable in the HBHA Pond unless a groundwater treatment technology is utilized to prevent contaminated groundwater discharges to the Pond that would recontaminate Pond sediments. B. Treatment equipment would be available to treat anticipated volume of contaminated near-shore sediment that would be removed from the Wells G&H Wetland and Cranberry Bog Conservation Area; and contaminated sediment in the HBHA Pond.	Capital: High O&M: Low

Notes:

1. The following are the criteria that are used to evaluate the effectiveness of a remedial alternative (RI/FS guidance Section 4.3.2.1; USEPA, October 1988). Protectiveness statements for this screening focused on the protection of human health, since human health risks are the driver for sediment remediation at these locations:
   A. Protects human health and the environment in short term (during construction and implementation period).
   B. Protects human health and the environment in long term (period after the remediation is complete).
   C. Reduces the toxicity, mobility, or volume of contaminants through treatment.
2. The following are the criteria that were used to evaluate the implementability of a remedial alternative (RI/FS guidance Section 4.3.2.2; USEPA, October 1988):
   A. Technical feasibility, i.e. ability to construct, reliably operate, and meet technology-specific regulations for process options until the remedial action is complete. Operation, maintenance, and monitoring of alternative also included.
   B. Administrative feasibility, i.e. ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services (including capacity).
3. The cost evaluation that was conducted for the alternatives screening included a comparative evaluation of costs between sediment remedial alternatives.

TABLE 3-4
SCREENING OF REMEDIAL ALTERNATIVES FOR SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

ALTERNATIVE TITLE	DESCRIPTION	EFFECTIVENESS[1]	IMPLEMENTABILITY[2]	COST[3]
No Action	See Section 3.5.1	A. Would protect the environment in the short term (no construction involved). B. Would not protect the environment in the long term without other measures. C. No reduction in the toxicity, mobility, or volume of contaminants through active treatment.	A. Technically feasible. B. Administratively feasible.	Capital: None O&M: None
Monitoring	See Section 3.5.2	A. Would protect the environment in the short term (no construction involved). B. Would not protect the environment in the long term without other measures. C. No reduction in the toxicity, mobility, or volume of contaminants through active treatment.	A. Technically feasible. B. Administratively feasible	Capital: Low O&M: Low
Monitoring and Providing an Alternate Habitat	See Section 3.5.3	A. Would protect the environment in the short term with controls. B. Would not protect the immediate environment in the HBHA Pond in the long term without other measures. Would however protect the wetland habitat inventory within the watershed. C. Toxicity, mobility, and volume of contaminants would not be reduced through treatment.	A. Technical feasibility would need to be addressed through an evaluation of available real estate within the watershed that would be suitable for creating a similar wetland habitat. B. Administratively feasible. Technical specialists readily available to design and construct compensatory wetlands.	Capital: Medium O&M: Medium

Notes:

1. The following are the criteria that are used to evaluate the effectiveness of a remedial alternative (RI/FS guidance Section 4.3.2.1; USEPA, October 1988). Protectiveness statements for this screening focused on the protection of human health, since human health risks are the driver for groundwater remediation at this site.
   A. Protects human health and the environment in short term (during construction and implementation period).
   B. Protects human health and the environment in long term (period after the remediation is complete).
   C. Reduces the toxicity, mobility, or volume of contaminants through treatment.
2. The following are the criteria that were used to evaluate the implementability of a remedial alternative (RI/FS guidance Section 4.3.2.2; USEPA, October 1988):
   A. Technical feasibility, i.e. ability to construct, reliably operate, and meet technology-specific regulations for process options until the remedial action is complete. Operation, maintenance, and monitoring of alternative also included.
   B. Administrative feasibility, i.e. ability to obtain approvals from other offices and agencies; the availability of treatment, storage, and disposal services (including capacity).
3. The cost evaluation that was conducted for the alternatives screening included a comparative evaluation of costs between groundwater remedial alternatives.

TABLE 3-5
SELECTED SOIL ALTERNATIVES FOR DETAILED ANALYSIS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Medium	Remedial Alternative
Surface Soil	No Action
	Institutional Controls with Monitoring
	Permeable Cover and Monitoring with Institutional Controls
	Excavation and Off-Site Disposal
	Excavation, Treatment, and On-Site Reuse
Subsurface Soil	No Action
	Institutional Controls with Monitoring
	Permeable Cover and Monitoring with Institutional Controls

TABLE 3-6
SELECTED GROUNDWATER ALTERNATIVES FOR DETAILED ANALYSIS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Medium	Remedial Alternative
Groundwater	No Action
	Pond Intercept with Monitoring and Institutional Controls
	Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls
	Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls

TABLE 3-7
SELECTED SEDIMENT ALTERNATIVES FOR DETAILED ANALYSIS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Medium	Remedial Alternative
Near Shore Sediment	No Action
	Institutional Controls
	Monitoring with Institutional Controls
	Removal and Off-Site Disposal
Deep Sediment	No Action
	Monitoring with Institutional Controls
	Removal and Off-Site Disposal
HBHA Pond Sediment	No Action
	Monitoring
	Subaqueous Cap
	Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat
	Removal and Off-Site Disposal

TABLE 3-8
SELECTED SURFACE WATER ALTERNATIVES FOR DETAILED ANALYSIS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Medium	Remedial Alternative
Surface Water	No Action
	Monitoring
	Monitoring and Providing an Alternate Habitat

TABLE 4-1A
ALTERNATIVE SS-1 (NO ACTION) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no action-specific ARARs for alternative SS-1.	No action would be taken under Alternative SS-1 that will invoke an action-specific ARAR.

TABLE 4-1B
ALTERNATIVE SS-1 (NO ACTION) - LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative SS-1.	No action would be taken under Alternative SS-1 that will invoke a location-specific ARAR.

TABLE 4-1C
ALTERNATIVE SS-1 (NO ACTION) - CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-1D
DETAILED ANALYSIS OF ALTERNATIVE SS-1
NO ACTION – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in surface soil within the former Mishawum Lake bed area. Because this alternative does not take action to mitigate these risks, this alternative does not provide any protection to human health.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to surface soil within the former Mishawum Lake bed area. Therefore, despite the fact that no actions would be taken under this alternative, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	There are no chemical-specific ARARs identified for this alternative.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	Since there are no actions associated with this alternative, there are no action-specific ARARs identified.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for surface soil that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate potential future exposures to surface soil. All of the potential risks associated with exposure to contaminants in surface soil would remain. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken under this alternative, no provisions would be taken to control future exposures to surface soil. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.

TABLE 4-1D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-1
NO ACTION – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for surface and subsurface soil would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in surface soil.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.

TABLE 4-1D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-1
NO ACTION – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-2A
ALTERNATIVE SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practical alternative method to work in wetland buffer zones (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation controls would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation controls would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated soils using this criteria to determine whether they should be managed as hazardous waste.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure with surface soils, and groundwater monitoring would ensure that there is no migration of contamination from the soil.

TABLE 4-2A (cont.)
ALTERNATIVE SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.

TABLE 4-2B
ALTERNATIVE SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practical alternative method to work within wetland buffer zones (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.

TABLE 4-2C
ALTERNATIVE SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-2D
DETAILED ANALYSIS OF ALTERNATIVE SS-2
INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in surface soil within the former Mishawum Lake bed. This alternative would utilize institutional controls such as deed restrictions and local ordinances to restrict future on-site activities that would create exposures to contaminated surface soil. The overall protection of human health that would be provided by this alternative would be limited by the extent to which these restrictions can be enforced. The overall protection of human health that would be provided by this alternative would be further limited by the accessibility of surface soil to human receptors.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to surface or subsurface soil within the former Mishawum Lake bed. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	There were no chemical-specific ARARs identified for soil.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-2B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-2A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for surface soil that were established based on human health risk assessment guidance so long as institutional controls are adequately enforced.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be moderate since no on-site actions would be taken to treat, contain, or remove contaminated surface soil. Efforts would be made, through the restriction on future on-site activities and fencing, to control potential future exposures to contaminated soil. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure to soils, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.

TABLE 4-2D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-2
INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	Since no technologies would be utilized under this alternative, no process efficiencies or performance standards would need to be met and no technical components would need to be replaced. Since no treatment, containment, or removal of contaminants would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic inspections for evidence of human contact with contaminated soil. There is some uncertainty that institutional controls could adequately control potential human exposures to contaminated surface soil since contamination is located close to the ground surface in an area that is readily accessible to human receptors.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from the implementation of this alternative since no on-site actions would be taken.
Environmental Impacts	No impacts to the environment would result from the implementation of this alternative since no on-site actions would be taken.
Time Until Remedial Action Objectives are Achieved	Protection against potential future exposures to surface soil that would be provided by the imposition of institutional controls would be achieved as soon as the appropriate legal agreements can be drafted and approved. To the extent that these controls or restrictions can be effectively enforced, this would achieve the remedial action objectives for surface soil.

TABLE 4-2D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-2
INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no on-site construction activities would be undertaken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions would be necessary if institutional controls do not prove to be an effective deterrent to the types of activities that would cause unacceptable exposures to contaminated soil. Additional remedial actions could easily be taken if necessary to contain, remove, or treat soil so that there is no longer a potential risk associated with future exposures to surface soil.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in soil. No migration or exposure pathways exist that cannot by monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$185,000
Operations and Maintenance Costs	$30,000/year
Present Worth Costs	$600,000

TABLE 4-3A
ALTERNATIVE SS-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells, excavation, and placement of cover materials) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA would assess the contaminated soils using this criterion to determine whether they should be managed as hazardous waste.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure with surface soils, and groundwater monitoring would ensure that there is no migration of contamination from the soil.

TABLE 4-3A (cont.)
ALTERNATIVE SS-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained. There is no practicable alternative method that would be less damaging to resource areas and all practical measures will be taken to minimize adverse impacts to wetlands.
	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures would ensure that Alternative SS-3 complies with this ARAR.

TABLE 4-3B
ALTERNATIVE SS-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells, excavation, and placement of cover materials) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Statement of Procedures on Wetlands Protection ,40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts -Hazardous Waste Regulation (310 CMR 30.000)	Applicable	Requirements for transport and long-term storage of RCRA hazardous waste in containers and tank systems	Alternative SS-3 would comply with this ARAR. Surplus excavated soils removed in order to accommodate the cover construction materials would be analyzed and managed onsite in accordance with this ARAR if off-site disposal is required.
	Massachusetts Solid Waste Management Regulations (310 CMR 19.00)	Relevant and Appropriate	These regulations establish the requirements for solid waste facilities located within the Commonwealth of Massachusetts.	The design specifications and required construction procedures would ensure that SS-3 will comply with this ARAR.

TABLE 4-3C
ALTERNATIVE SS-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-3D
DETAILED ANALYSIS OF ALTERNATIVE SS-3
PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS –
MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in surface soil within the former Mishawum Lake bed. This alternative would prevent future direct contact with contaminated surface soils by containing them below a permeable cover that supplements the existing impermeable surface (asphalt) that covers much of the former lake bed (see Figure 2-3a). In areas that are currently vegetated, and where potential human health risks were identified due to future exposures to surface, permeable caps would be installed. The construction of permeable caps would be preceded by the excavation of approximately 1.5 feet of contaminated soil, which would be transported to an off-site landfill for disposal. A geotextile would be placed and covered with 1.5 feet of clean soil to form the permeable cover. Institutional controls such as deed restrictions and local ordinances will placed on both the permeable caps and asphalt surfaces within the human health risk areas to restrict future on-site activities that would create exposures to contaminated soil.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to surface soil within the former Mishawum Lake bed. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	There were no chemical-specific ARARs identified for soil.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs listed in Table 4-3B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs listed in Table 4-3A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for surface soil that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be low since all of the areas where contaminated surface soil was determined to present future human health risks are/would be covered by existing impermeable surfaces (asphalt) or newly created permeable covers consisting of 1.5 feet of clean soil. Restrictions will be placed on future on-site activities to prevent potential future exposures to contaminated surface soil. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure to surface soils, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.

TABLE 4-3D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-3
PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS –
MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	The technology that would be used under this alternative could easily and reliably meet the performance specifications that would be required. Long-term maintenance and monitoring would be required to ensure that the condition of asphalt surfaces and permeable covers remains adequate to protect human health. Long-term monitoring would likely consist of periodic inspections for evidence of erosion, disturbance of the cover, or asphalt deterioration. Some level of repairs would be necessary when erosion or damage of cap/cover materials is extensive enough to create a potential risk of exposure to underlying soils. Replacement or repair of asphalt or permeable cap material would involve routine maintenance activities that could be easily implemented. Institutional controls that would be relied upon to protect the integrity of the asphalt cap/permeable cover that would be constructed and maintained under this alternative would be reliable to the extent that such controls could be enforced.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Impacts to the community during construction of permeable covers would be minimal. Areas where excavation would be conducted to remove surface soils prior to placement of the cover would be periodically sprayed with water to prevent fugitive dust emissions. Perimeter air and dust monitoring would be conducted to verify the effectiveness of dust and air pollution control measures. A traffic control plan would be developed to minimize impacts to local traffic flow patterns in the construction areas and to address the increased truck traffic in the area that might result from construction. Trucks and other heavy equipment will be decontaminated before leaving work areas to prevent the spread of contaminants onto public or private roadways. There would be no short-term risks associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.

TABLE 4-3D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-3
PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS –
MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Protection of Workers During Remedial Actions	Impacts to workers during remedial actions would be minimal. Construction activities that would occur under this alternative would be completed in accordance with all required health and safety regulations and procedures. Air monitoring and engineering controls will be utilized to assess and minimize exposure to contaminants by workers. The appropriate personal protective equipment would be worn during implementation, and decontamination procedures would be utilized to prevent the spread of contaminants. There would be no short-term risks to workers associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Environmental Impacts	No adverse impacts to the environment would result from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	The estimated duration of construction activities that would occur under this alternative is 3 months, after which time the remedial action objectives for soil will have been achieved (assuming that institutional controls are in place by the time that construction of the cover is completed).
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative. All activities that are part of the alternative involve conventional construction techniques and equipment.
Reliability of the Technology	Technical problems that might delay the construction schedule are unlikely, since the alternative utilizes conventional and well-developed construction techniques to achieve remediation goals.
Ease of Undertaking Additional Remedial Actions, if Necessary	No future remedial actions would be anticipated after the implementation of this remedial alternative. If additional remedial actions were required to address contaminated soil located beneath the cover, the presence of the geotextile and 1.5 feet of clean soil may complicate remedial efforts if they involve soil removal or some other process that necessitates direct contact with underlying soil.
Ability to Monitor Effectiveness of Remedy	No migration or exposure pathways exist that cannot be monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Capacity for the off-site disposal of contaminated soil that would be required under this alternative would be readily available from several facilities.
Availability of Necessary Equipment and Specialists	Equipment and technical specialists required for the design and implementation of this alternative would be available. This alternative would use conventional construction techniques.

TABLE 4-3D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-3
PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS –
MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Prospective Technologies	All technologies are well-developed and readily available.
7. Cost	
Capital Costs	$5,329,000
Operations and Maintenance Costs	$48,000/year
Present Worth Costs	$5,992,000

TABLE 4-4A
ALTERNATIVE SS-4 (EXCAVATION AND OFF-SITE DISPOSAL) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated soils using this criteria to determine whether they should be managed as hazardous waste.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas. All practical measures would be taken to minimize adverse impacts on wetlands.

TABLE 4-4B
ALTERNATIVE SS-4 (EXCAVATION AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas. All practical measures would be taken to minimize adverse impacts to wetlands.

TABLE 4-4C
ALTERNATIVE SS-4 (EXCAVATION AND OFF-SITE DISPOSAL)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures would ensure that Alternative SS-4 will comply with this ARAR to minimize fugitive dust and particulate emissions during construction.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-4D
DETAILED ANALYSIS OF ALTERNATIVE SS-4
EXCAVATION AND OFF-SITE DISPOSAL – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in surface soil within the former Mishawum Lake bed. This alternative would protect human health by removing all soil that contains concentrations of arsenic that exceed the human health-based remediation goals and replacing it with clean soil that does not present a potential human health risk.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to surface soil within the former Mishawum Lake bed. Therefore, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with all of the pertinent chemical-specific ARARs that are identified on Table 4-4C.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-4B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-4A.
Other Criteria, Advisories, and Guidance	This alternative will comply with the PRGs for surface soil that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	No residual risk from surface soil within the former Mishawum Lake bed would be present after implementation of this alternative, since all surface soil with concentrations of arsenic exceeding human health-based remediation goals would be removed from the site and replaced with clean soil. No remaining sources of risk would be present in surface soils at the site. Since contamination would not remain in surface soil above levels allow for unlimited use and unrestricted exposure, no five-year reviews would be required to evaluate risks in surface soil.
Adequacy and Reliability of Controls	The excavation of contaminated surface soil from the former Mishawum Lake bed would include the collection of confirmatory soil samples from excavated areas to confirm that all remediation goals for surface soil are met. This type of contaminated soil removal is very reliable and would be expected to achieve the remedial action's performance specification with a high degree of certainty. No long-term management, monitoring, or operations and maintenance would be required for surface soil under this alternative since all contaminants in surface soil that exceed risk-based remediation goals would be removed from the site. This alternative would not rely on technical components to control future risks. No uncertainties would be associated with the disposal of untreated wastes that would occur under this alternative. Disposal would be at a licensed landfill that is permitted to receive wastes with the chemical constituents that are present in site soils.

TABLE 4-4D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-4
EXCAVATION AND OFF-SITE DISPOSAL – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants through treatment under this alternative.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Impacts to the community during implementation of this alternative would be significant. Excavation of surface soil throughout the surface soil contamination area (approximately 500,000 square feet) would cause considerable disruption to the ongoing activities on the impacted properties. Traffic control plans and phased implementation strategies would need to be developed in order to minimize impacts to local traffic flow patterns and business operations in the excavation areas. The design of these measures would be challenging. The community would not be impacted by environmental contaminants from the implementation of this alternative. Engineering controls would be used to prevent community exposure to airborne contaminants during excavation and transportation of contaminated soil. Trucks and other excavation equipment will be decontaminated before leaving work areas to prevent the spread of contaminants onto public or private roadways.
Protection of Workers During Remedial Actions	Impacts to workers during remedial actions would be minimal. Excavation and construction activities that would occur under this alternative would be completed in accordance with all required health and safety regulations and procedures. Air monitoring and engineering controls will be utilized to assess and minimize exposure to contaminants by workers. The appropriate personal protective equipment will be worn during implementation, and decontamination procedures would be utilized to prevent the spread of contaminants. There would be no short-term risks to workers associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Environmental Impacts	This alternative would involve moderate impacts to the environment since excavation would be performed in the 100-year floodplain (adjacent to the Halls Brook Holding Area).

TABLE 4-4D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-4
EXCAVATION AND OFF-SITE DISPOSAL – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Time Until Remedial Action Objectives are Achieved	The estimated duration of the construction activities that would be performed under this alternative would be approximately 11 months. After this period of time, all threats associated with surface soil at the site would be addressed and all remedial action objectives pertaining to surface soil will have been achieved.
6. Implementability	
Ability to Construct and Operate the Technology	Excavation and off-site disposal of surface soil (0 to 3 feet below ground surface) in the area shown on Figure 2-3a would be technically implementable from a construction standpoint. Operationally, some difficulty may be encountered in the coordination of construction activities with the existing use of the properties that would be excavated. Soil excavation would need to be phased in order to permit use of the developed portions of the work area during implementation.
Reliability of the Technology	Excavation is a commonly utilized construction technique/process that is very reliable. It is very unlikely that a technical problem would lead to schedule delays.
Ease of Undertaking Additional Remedial Actions, if Necessary	It is unlikely that future additional remedial actions would be necessary since excavation with confirmatory soil sampling would ensure that all contaminated surface soil is removed from the site. If future remedial actions were deemed necessary, the performance of this alternative would not have any impact on the future implementation of additional actions.
Ability to Monitor Effectiveness of Remedy	The effectiveness of this alternative would be monitored during excavation through the use of excavation bottom and sidewall samples to confirm that no soil remains at the site with concentrations of arsenic that might constitute a future human health risk. No soil monitoring would be necessary after completion of the remedy and no potential migration or exposure pathways would need to be monitored.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Several off-site disposal facilities would be available to handle the anticipated volume of soil that would be excavated and transported for off-site disposal under this alternative.
Availability of Necessary Equipment and Specialists	This alternative uses conventional construction equipment to accomplish soil removal. Equipment, and skilled labor required to perform the alternative would be readily available from several sources.
Availability of Prospective Technologies	Excavation and off-site disposal of contaminated soil is a commonly used remedial option that is proven and reliable.

TABLE 4-4D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-4
EXCAVATION AND OFF-SITE DISPOSAL – MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
7. Cost	
Capital Costs	$47,172,000
Operations and Maintenance Costs	$0
Present Worth Costs	$47,172,000

TABLE 4-5A
ALTERNATIVE SS-5 (EXCAVATION, TREATMENT, AND ON-SITE REUSE)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact. All practicable measures will be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated soils using this criteria to determine whether they should be managed as hazardous waste.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas. All practical measures would be taken to minimize adverse impacts on wetlands.

TABLE 4-5B
ALTERNATIVE SS-5 (EXCAVATION, TREATMENT, AND ON-SITE REUSE)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.

TABLE 4-5C
ALTERNATIVE SS-5 (EXCAVATION, TREATMENT AND ON-SITE REUSE)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures would ensure that Alternative SS-5 will comply with this ARAR to minimize fugitive dust and particulate emissions during construction.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-5D
DETAILED ANALYSIS OF ALTERNATIVE SS-5
EXCAVATION, TREATMENT, AND ON-SITE REUSE – FORMER MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in surface soil within the former Mishawum Lake bed. This alternative would protect human health by removing all surface soil that contains concentrations of arsenic that exceed the human health-based remediation goals, treating soil to remove contaminants, and backfilling excavations with treated soil that does not pose a potential human health risk.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to surface soil within the former Mishawum Lake bed. Therefore, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with all of the pertinent chemical-specific ARARs that are identified on Table 4-5C.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-5B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-5A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs established for surface soil that were based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	No residual risk from surface soil within the former Mishawum Lake bed would be present after implementation of this alternative, since all surface soil with concentrations of arsenic exceeding human health-based remediation goals would be treated to remove arsenic so that it would no longer be accessible to human receptors. No remaining sources of risk would be present in soils at the site. Since contamination would not remain in soil above levels allow for unlimited use and unrestricted exposure, no five-year reviews would be required to evaluate risks in soil.
Adequacy and Reliability of Controls	The excavation of contaminated soil from the former Mishawum Lake bed (that would be required in order to perform ex-situ treatment of soil) would include the collection of confirmatory soil samples from excavated areas to confirm that all remediation goals for surface soil are met. This type of contaminated soil removal is very reliable and would be expected to achieve the remedial action's performance specification with a high degree of certainty. Treated soil would also be sampled at regular intervals prior to backfilling to ensure that remediation goals are achieved.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	Acid extraction would remove arsenic from soil, which is the principal threat that contributes to unacceptable human health risks that were calculated for surface soil.

TABLE 4-5D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-5
EXCAVATION, TREATMENT, AND ON-SITE REUSE – FORMER MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Amount of Hazardous Materials Destroyed or Treated	Ex-situ treatment will not destroy contaminants. Contaminants will be removed from soil and transferred to the extraction solution, which would need to be treated or disposed of. The entire volume of excavated material (approximately 65,000 CY) would be treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	The toxicity, mobility, and volume of arsenic would be reduced to levels below the remediation goal for arsenic (51 mg/kg arsenic).
Degree to Which Treatment is Irreversible	The treatment process would be irreversible. Contaminants would be separated from soil and transferred to the extraction fluid.
Type and Quantity of Residuals Remaining After Treatment	There would be no risks associated with treatment residuals from the treatment process. Contaminated aqueous material into which arsenic would be transferred would be transported to a treatment/disposal facility that is licensed to handle the material.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Impacts to the community during implementation of this alternative would be similar to those described for Alternative SS-4 (Table 4-4D), since excavation would occur in the same areas to the same depth as was specified for that alternative. The only additional process involved in Alternative SS-5 is the treatment process, which would be operated in a manner that utilized engineering controls to prevent adverse impacts to the community. There would be no short-term risks associated with the implementation of this alternative that could not be readily controlled using some type of engineering control, beyond those impacts potentially associated with a large-scale excavation project within an area that supports active businesses.
Protection of Workers During Remedial Actions	Impacts to workers during remedial actions would be minimal. Excavation, construction, and on-site treatment activities that would occur under this alternative would be completed in accordance with all required health and safety regulations and procedures. Air monitoring and engineering controls will be utilized to assess and minimize exposure to contaminants by workers. The appropriate personal protective equipment will be worn during implementation, and decontamination procedures would be utilized to prevent the spread of contaminants. There would be no short-term risks to workers associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Environmental Impacts	No adverse impacts to the environment would result from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	The estimated duration of the construction and treatment activities that would be performed under this alternative would be 14 months. After this period of time, all threats associated with soil at the site would be addressed and all remedial action objectives pertaining to surface soil will have been achieved.

TABLE 4-5D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-5
EXCAVATION, TREATMENT, AND ON-SITE REUSE – FORMER MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	In order to perform ex-situ treatment on arsenic-contaminated soils, these soils must be removed from the subsurface. The ability to excavate contaminated soil from the contaminated areas within the former lake bed (Figure 2-3a) would be as described on Table 4-4D for Alternative SS-4. Ex-situ acid extraction has been used to treat arsenic-contaminated soil in at least four full-scale applications at Superfund sites. Uncertainties that would be encountered for the treatment process would include the ability of the treatment process to meet remediation goals for all soils that are treated. A treatability study would be performed to verify that the process could meet this goal.
Reliability of the Technology	Excavation is a commonly utilized construction technique/process that is very reliable. It is very unlikely that a technical problem associated with soil removal or backfilling would lead to schedule delays. The construction and operation of an on-site treatment facility to treat arsenic-contaminated soil could present the possibility of technical difficulties that lead to schedule delays, since full-scale systems of this type have only been used in a limited number of applications.
Ease of Undertaking Additional Remedial Actions, if Necessary	It is unlikely that future additional remedial actions would be necessary since excavation with confirmatory soil sampling would ensure that all contaminated surface soil is removed from the site, and treatment of soil would permanently remove contaminants from soil. If future remedial actions were deemed necessary, the performance of this alternative would not have any impact on the future implementation of additional actions.
Ability to Monitor Effectiveness of Remedy	The effectiveness of this alternative would be monitored during excavation through the use of excavation bottom and sidewall samples to confirm that no surface soil remains at the site with concentrations of arsenic that might constitute a human health risk. No soil monitoring would be necessary after completion of the remedy since arsenic would be permanently removed from excavated soil, and no potential migration or exposure pathways would need to be monitored.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this remedy.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this remedy.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Adequate capacity would be available for off-site disposal of arsenic-contaminated material (liquid or solid) that might be required to implement this alternative.
Availability of Necessary Equipment and Specialists	This alternative uses conventional construction equipment to accomplish soil removal prior to ex-situ treatment. The equipment and skilled labor required to perform excavation would be readily available from several sources. The availability of equipment and specialists to perform acid extraction could be limited since the technology is still relatively uncommon. At least two vendors would be available to provide acid extraction treatment services to remove arsenic from soil.

TABLE 4-5D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SS-5
EXCAVATION, TREATMENT, AND ON-SITE REUSE – FORMER MISHAWUM LAKE BED SURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Prospective Technologies	Treatment of arsenic-contaminated soil by acid extraction has been used in at least two full-scale applications at Superfund sites, and in several pilot-scale studies. Data from these applications demonstrate that it is capable of achieving the remediation goal for arsenic in sediment. At least two vendors would be available to provide bids to implement the technology.
7. Cost	
Capital Costs	$22,993,000
Operations and Maintenance Costs	$0
Present Worth Costs	$22,993,000

TABLE 4-6A
ALTERNATIVE SUB-1 (NO ACTION) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no action-specific ARARs for Alternative SUB-1.	No action would be taken under Alternative SUB-1 that would invoke an action-specific ARAR.

TABLE 4-6B
ALTERNATIVE SUB-1 (NO ACTION) - LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative SUB-1.	No action will be taken under Alternative SUB-1 that will invoke a location-specific ARAR.

TABLE 4-6C
ALTERNATIVE SUB-1 (NO ACTION) - CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-6D
DETAILED ANALYSIS OF ALTERNATIVE SUB-1
NO ACTION – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in subsurface soil within the former Mishawum Lake bed. Because this alternative does not take action to mitigate these risks, this alternative does not provide any protection to human health.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to subsurface soil within the former Mishawum Lake bed. Therefore, despite the fact that no actions would be taken under this alternative, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	There were no chemical-specific ARARs identified for soil.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	Since there are no actions associated with this alternative, there are no action-specific ARARs identified.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for subsurface soil that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate potential future exposures to subsurface soil. All of the potential risks associated with exposure to contaminants in subsurface soil would remain. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken under this alternative, no provisions would be taken to control future exposures to subsurface soil. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.

TABLE 4-6D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-1
NO ACTION – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for subsurface soil would not be achieved in the reasonably foreseeable future.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in subsurface soil.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.

TABLE 4-6D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-1
NO ACTION – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-7A
ALTERNATIVE SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING) ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact, and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure with subsurface soils, and groundwater monitoring would be used to ensure that there is no migration of contamination from the soil.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts on wetlands.

TABLE 4-7B
ALTERNATIVE SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts to wetlands.

TABLE 4-7C
ALTERNATIVE SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-7D
DETAILED ANALYSIS OF ALTERNATIVE SUB-2
MONITORING WITH INSTITUTIONAL CONTROLS - MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in subsurface soil (3-15 feet) within the former Mishawum Lake bed area (see Figure 2-3b). This alternative would utilize institutional controls such as deed restrictions and local ordinances to restrict future on-site activities (such as excavation) that would create exposures to contaminated subsurface soil. The overall protection of human health that would be provided by this alternative would be limited by the extent to which these restrictions can be enforced.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to subsurface soil within the former Mishawum Lake bed. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	No chemical-specific ARARs were identified for subsurface soils.
Location-Specific ARARs	This alternative will comply with the pertinent location-specific ARARs listed in Table 4-7B.
Action-Specific ARARs	This alternative will comply with the pertinent action-specific ARARs listed in Table 4-7A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for subsurface soil that were established based on human health risk assessment guidance so long as institutional controls are adequately enforced.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be low to moderate. No on-site actions would be taken to treat, contain, or remove contaminated surface soil; but efforts would be made, through the restriction on future on-site activities, to control potential future exposures to contaminated subsurface soil. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure to surface soils, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no technologies would be utilized under this alternative, no process efficiencies or performance standards would need to be met and no technical components would need to be replaced. Since no treatment, containment, or removal of contaminants would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic inspections for evidence of human contact with contaminated soil. Since contaminated subsurface soil is located at a depth that virtually isolates it from human contact (greater than 3 feet below ground surface), there is a high level of certainty that institutional controls could adequately control potential human exposures to contaminated subsurface soil.

TABLE 4-7D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-2
MONITORING WITH INSTITUTIONAL CONTROLS - MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from the implementation of this alternative since no on-site actions would be taken.
Environmental Impacts	No impacts to the environment would result from the implementation of this alternative since no on-site actions would be taken.
Time Until Remedial Action Objectives are Achieved	Protection against potential future exposures to surface soil that would be provided by the imposition of institutional controls would be achieved as soon as the appropriate legal agreements can be drafted and approved. To the extent that these controls or restrictions can be effectively enforced, this would achieve the remedial action objectives for subsurface soil.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no on-site construction activities would be undertaken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if institutional controls do not prove to be an effective deterrent to the types of activities that would cause unacceptable exposures to contaminated subsurface soil. Additional remedial actions could easily be taken if necessary.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in surface soil. No migration or exposure pathways exist that cannot by monitored adequately.

TABLE 4-7D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-2
MONITORING WITH INSTITUTIONAL CONTROLS - MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Ability to Obtain Approvals from Other Agencies	No approvals from other agencies would be required to implement this alternative.
Coordination with Other Agencies	No coordination with other agencies would be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$315,000
Operations and Maintenance Costs	$108,000/year (Years 1-10) $30,000/year (Years 11-30)
Present Worth Costs	$1,276,000

TABLE 4-8A
ALTERNATIVE SUB-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells, excavation, and placement of cover materials) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated soils using this criteria to determine whether they should be managed as hazardous waste.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure to subsurface soils, and groundwater monitoring would be used to ensure that there is no migration of contamination from the soil.

TABLE 4-8A (cont.)
ALTERNATIVE SUB-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts on wetlands.
	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures would ensure that Alternative SUB-3 will comply with this ARAR.

TABLE 4-8B
ALTERNATIVE SUB-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts on wetlands.

TABLE 4-8C
ALTERNATIVE SUB-3 (PERMEABLE COVER AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-8D
DETAILED ANALYSIS OF ALTERNATIVE SUB-3
PERMEABLE COVER WITH MONITORING AND INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic in subsurface soil within the former Mishawum Lake bed (see Figure 2-3b). This alternative would prevent future direct contact with contaminated subsurface soils by containing them below a permeable cover that supplements the existing impermeable surface (asphalt) that covers much of the former lake bed, and imposing institutional controls on these properties to prohibit activities that might present unacceptable direct contact risks in the future. In areas that are currently vegetated, and where potential human health risks were identified due to future exposures to subsurface soil, permeable caps would be installed. The construction of permeable caps would be preceded by the excavation of approximately 1.5 feet of contaminated soil, which would be transported to an off-site landfill for disposal. A geotextile would be placed and covered with 1.5 feet of clean soil to form the permeable cover. Institutional controls such as deed restrictions and local ordinances will placed on both the permeable caps and asphalt surfaces within the human health risk areas to restrict future on-site activities that would create exposures to contaminated soil.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to subsurface soil within the former Mishawum Lake bed. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	There were no chemical-specific ARARs identified for soil.
Location-Specific ARARs	This alternative will comply with the pertinent location-specific ARARs listed in Table 4-8B.
Action-Specific ARARs	This alternative will comply with the pertinent action-specific ARARs listed in Table 4-8A.
Other Criteria, Advisories, and Guidance	This alternative will comply with the PRGs for subsurface soil that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be low since all of the areas where contaminated subsurface soil was determined to present future human health risks are/would be covered by existing impermeable surfaces (asphalt) or newly created permeable covers consisting of 1.5 feet of clean soil. Restrictions will be placed on future on-site activities to prevent potential future exposures to contaminated subsurface soil. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure to subsurface soils, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.

TABLE 4-8D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-3
PERMEABLE COVER WITH MONITORING AND INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	The technology that would be used under this alternative could easily and reliably meet the performance specifications that would be required. Long-term maintenance and monitoring would be required to ensure that the condition of asphalt surfaces and permeable covers remains adequate to protect human health. Long-term monitoring would likely consist of periodic inspections for evidence of erosion, disturbance of the cover, or asphalt deterioration. Some level of repairs would be necessary when erosion or damage of cap/cover materials is extensive enough to create a potential risk of exposure to underlying soils. Replacement or repair of asphalt or permeable cap material would involve routine maintenance activities that could be easily implemented. Institutional controls that would be relied upon to protect the integrity of the asphalt cap/permeable cover that would be constructed and maintained under this alternative would be reliable to the extent that such controls could be enforced.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.

TABLE 4-8D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-3
PERMEABLE COVER WITH MONITORING AND INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Impacts to the community during construction of permeable covers would be high since much of this area includes active commercial businesses and existing parking lots. The construction design would have to consider sequencing activities to minimize these impacts. Coordination of a large-scale effort in an area such as the one impacted by this alternative could be challenging. Engineering controls would be utilized during excavation and cover placement to ensure that the community is not exposed to airborne contaminants. Areas where excavation would be conducted to remove surface soils prior to placement of the cover would be periodically sprayed with water to prevent fugitive dust emissions. Perimeter air and dust monitoring would be conducted to verify the effectiveness of dust and air pollution control measures. A traffic control plan would be developed to minimize impacts to local traffic flow patterns in the construction areas and to address the increased truck traffic in the area that might result from construction. Trucks and other heavy equipment will be decontaminated before leaving work areas to prevent the spread of contaminants onto public or private roadways. There would be no short-term risks associated with the implementation of this alternative that could not be readily controlled using some type of engineering control, beyond those associated with the implementation of a large-scale excavation project in an area that currently supports active businesses.
Protection of Workers During Remedial Actions	Impacts to workers during remedial actions would be minimal. Construction activities that would occur under this alternative would be completed in accordance with all required health and safety regulations and procedures. Air monitoring and engineering controls will be utilized to assess and minimize exposure to contaminants by workers. The appropriate personal protective equipment will be worn during implementation, and decontamination procedures would be utilized to prevent the spread of contaminants. There would be no short-term risks to workers associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Environmental Impacts	This alternative would involve moderate impacts to the environment since excavation would be performed in the 100-year floodplain (adjacent to the Halls Brook Holding Area).
Time Until Remedial Action Objectives are Achieved	The estimated duration of construction activities that would occur under this alternative is approximately 8 months, after which time the remedial action objectives for subsurface soil will have been achieved (assuming that institutional controls are in place as soon as construction is completed.

TABLE 4-8D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SUB-3
PERMEABLE COVER WITH MONITORING AND INSTITUTIONAL CONTROLS – MISHAWUM LAKE BED SUBSURFACE SOIL
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	All activities that are part of the alternative involve conventional construction techniques and equipment. Construction difficulties would be associated with underground utilities, the large volume of material requiring handling, and accommodations to local businesses.
Reliability of the Technology	Technical problems that might delay the construction schedule are unlikely, since the alternative utilizes conventional and well-developed construction techniques to achieve remediation objectives.
Ease of Undertaking Additional Remedial Actions, if Necessary	No future remedial actions would be anticipated after the implementation of this remedial alternative. If additional remedial actions were required, the activities and construction that would be conducted under this alternative would not add to the difficulty of performing other remedial actions within the former Mishawum Lake bed.
Ability to Monitor Effectiveness of Remedy	No migration or exposure pathways exist that cannot be monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Several off-site disposal facilities would be available to handle the anticipated volume of soil that would be excavated and transported for off-site disposal under this alternative.
Availability of Necessary Equipment and Specialists	This alternative uses conventional construction equipment to accomplish soil removal and to place geotextile and clean soil. Equipment, and skilled labor required to perform the alternative would be readily available from several sources.
Availability of Prospective Technologies	Excavation, off-site disposal, and permeable cover placement are commonly used remedial options that are proven and reliable.
7. Cost	
Capital Costs	$6,495,000
Operations and Maintenance Costs	$159,000/year (Years 1-10) $81,000/year (Years 11-30)
Present Worth Costs	$8,070,000

TABLE 4-9A
ALTERNATIVE GW-1 (NO ACTION) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no action-specific ARARs for Alternative GW-1.	No action would be taken under Alternative GW-1 that would invoke an action-specific ARAR.

TABLE 4-9B
ALTERNATIVE GW-1 (NO ACTION) - LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative GW-1.	No action would be taken under Alternative GW-1 that would invoke a location-specific ARAR.

TABLE 4-9C
ALTERNATIVE GW-1 (NO ACTION) - CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-9D
DETAILED ANALYSIS OF ALTERNATIVE GW-1
NO ACTION – GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic, benzene, trichloroethene (TCE), and/or 1,2-dichloroethane (DCA) in groundwater within the Northern Study Area by a construction worker, industrial worker, and car wash worker. Because this alternative does not take action to mitigate these risks, this alternative does not provide any protection to human health.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to groundwater. However, the fate and transport evaluation for the Northern Study Area indicates that groundwater is providing a continuing source of contamination to sediment in the HBHA Pond, which contributes to unacceptable risks to benthic communities in the Pond. Contaminants are believed to enter Pond sediments via groundwater discharges to the northern half of the eastern side of the HBHA Pond. Since no actions would be taken to decrease contaminant concentrations in groundwater at the site, this alternative would not prevent the continued transport of contaminants into sediments that pose unacceptable ecological risks.
2. Compliance with ARARs	
Chemical-Specific ARARs	There are no chemical-specific ARARs identified for this alternative.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	Since there are no actions associated with this alternative, there are no action-specific ARARs identified.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for groundwater established based on human health and ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to prevent future exposures to contaminated groundwater in the Northern Study Area and no actions would be taken to prevent discharges of contaminated groundwater to the HBHA Pond (which have been identified as a continuing source of sediment contamination related to ecological risk in the HBHA Pond). Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken under this alternative, no provisions would be taken to control future exposures to groundwater or future discharges of contaminated groundwater to the HBHA Pond. No technologies would be utilized, therefore no operations and maintenance would be required.

TABLE 4-9D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-1
NO ACTION – GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for groundwater would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in groundwater.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.

TABLE 4-9D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-1
NO ACTION – GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-10A
ALTERNATIVE GW-2 (POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS) ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Alternative GW-2 would comply with this ARAR. Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration into HBHA Pond.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.

TABLE 4-10B
ALTERNATIVE GW-2 (POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS) LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.

TABLE 4-10C
ALTERNATIVE GW-2 (PLUME INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS) CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	NRWQC for arsenic and other site-related constituents would be achieved at the point of compliance (south of the HBHA cofferdam) and in the river downstream of the cofferdam.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-10D
DETAILED ANALYSIS OF ALTERNATIVE GW-2
POND INTERCEPT WITH MONITORING AND INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic, benzene, trichloroethene (TCE), naphthalene, and/or 1,2-dichloroethane (DCA) in groundwater within the Northern Study Area by a construction worker, industrial worker, and car wash worker. This alternative does not take action to contain, remove, or treat these contaminants; but protection of human health would be accomplished through the imposition of institutional controls on the impacted properties to prevent the withdrawal and use of groundwater. The overall protection of human health that would be provided by this alternative would be limited to the extent that the institutional controls can be adequately enforced.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to groundwater. However, the fate and transport evaluation for the Northern Study Area indicates that groundwater is providing a continuing source of contamination to sediment in the HBHA Pond, which contributes to unacceptable risks to benthic communities in the Pond. Contaminants are believed to enter Pond sediments via groundwater discharges to the northern half of the eastern side of the HBHA Pond. Since no actions would be taken to decrease contaminant concentrations in groundwater at the site, this alternative would not prevent the continued transport of contaminants into sediments that pose unacceptable ecological risks.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with all of the pertinent chemical-specific ARARs that are identified on Table 4-10C beginning at the point of compliance, on the downstream side of the cofferdam.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-10B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-10A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for groundwater that were established based on human health and ecological risk assessment guidance, so long as the institutional controls are enforced.

TABLE 4-10D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-2
POND INTERCEPT WITH MONITORING AND INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual human health risk that would result from the selection of this alternative would be moderate since no actions would be taken to contain or treat contaminated groundwater in the human health risk areas (see Figure 2-4), and the prevention of future exposures to contaminated groundwater would be dependent upon the enforcement of institutional controls. No actions would be taken to prevent discharges of contaminated groundwater to the HBHA Pond (which have been identified as a continuing source of sediment contamination related to ecological risk in the Pond), therefore residual ecological risks would remain in the HBHA Pond due, in part, from continued discharges of groundwater to the Pond. Due to the fact that contaminants levels will remain at the site above levels which permit unlimited exposure and unrestricted use, five-year reviews would be required to periodically evaluate risks associated with on-site contamination until remediation goals are achieved.
Adequacy and Reliability of Controls	Institutional controls would be adequate to prevent future exposures to groundwater in the human health risk area. Periodic inspections would be conducted to verify the effectiveness of the controls at preventing exposures to contaminated groundwater. Groundwater monitoring would be conducted to periodically evaluate contaminant migration patterns and to periodically address risks. In order to ensure the long-term effectiveness of this alternative as it pertains to limiting the mobility of contaminants, it would need to be implemented along with an HBHA Pond alternative that provides measures to maintain the effectiveness of the chemocline that currently exists in the Pond. Without this contaminant sequestering mechanism, groundwater that discharges to the Pond under this alternative would continue to provide a source of contaminants to sediment that ultimately would resuspend into the water column and migrate to downstream areas, potentially creating future risks at downstream locations.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	Contaminants (arsenic/benzene) would not be actively treated within the groundwater plume area under this alternative, but instead allowed to discharge to the HBHA Pond, where they would be removed from water column and sequestered in the sediments at the Pond bottom.
Amount of Hazardous Materials Destroyed or Treated	Most of the organic contaminants in groundwater (benzene) are believed to naturally biodegrade as groundwater discharges to the Pond. Arsenic in groundwater that discharges to the Pond is removed from the water column through physical processes. Contaminant removal rates are sufficiently high that elevated concentrations of contaminants in surface water (i.e. those that present potential ecological risks) are isolated to a small portion of the Pond. Contaminants that are not removed (through natural processes) from groundwater that discharges to the Pond are believed to be sequestered at the Pond bottom due to the presence of a chemocline located about halfway between the surface and bottom of the Pond. This mechanism limits the mobility of contaminants so long as the chemocline is maintained.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	The mobility of contaminants would be limited as long as the chemocline in the HBHA Pond is maintained. The toxicity and volume of contaminants would be reduced to the extent that natural degradation is occurring.

TABLE 4-10D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-2
POND INTERCEPT WITH MONITORING AND INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	Biodegradation of organic contaminants is irreversible. Removal of arsenic from groundwater through physical processes (diffusion, precipitation) is reversible since contaminants can be remobilized into the water column.
Type and Quantity of Residuals Remaining After Treatment	As contaminants are removed from groundwater that discharges to the HBHA Pond, they are believed to become part of the sediment load at the bottom of the Pond. It is believed that if contaminated groundwater is allowed to discharge to the Pond, sediment will continue to accumulate at the Pond bottom. Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternative Habitat) provides for the periodic dredging and off-site disposal of contaminated sediment that accumulates at the bottom of the Pond due to contaminated groundwater discharges to the Pond.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no on-site actions would be taken to contain or treat groundwater under this alternative.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no on-site actions would be taken.
Environmental Impacts	No additional impacts to the environment would result from the implementation of this alternative. Contaminated groundwater would continue to discharge to the HBHA Pond, transporting contaminants into sediments and surface water at the Pond bottom.
Time Until Remedial Action Objectives are Achieved	Remedial action objectives (RAOs) for the protection of human health would be achieved once institutional controls have been placed on the impacted properties. RAOs for the protection of the environment would be not be achieved by this alternative. In order to achieve this RAO, this alternative would need to be implemented along with an alternative that provides an alternate habitat to compensate for the Pond habitat that would be lost due to continued discharges of groundwater.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no construction activities would be required.
Reliability of the Technology	Extensive study has been performed to verify the presence of physical, chemical, and biological processes that are responsible for the removal of contaminants from groundwater that discharges to the Pond. Provided that the existing conditions in the Pond are able to be maintained, these processes would be reliable to remove contaminants from groundwater, sequester them at the Pond bottom, and limit their mobility.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary.

TABLE 4-10D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-2
POND INTERCEPT WITH MONITORING AND INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in groundwater. Periodic inspections would be conducted to verify the effectiveness of institutional controls at preventing groundwater uses that might result in unacceptable human health risk.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	The technical specialists required to adequately monitor and assess the effectiveness of this alternative would be available.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$432,000
Operations and Maintenance Costs	$410,000/year -Years 1-5; 205,000/year Years 6-30
Present Worth Costs	$3,918,000

TABLE 4-11A
ALTERNATIVE GW-3 (PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	GW-3 would comply with this ARAR. Groundwater monitoring would be required to evaluate the performance of the extraction and treatment system and to monitor contaminant migration patterns within and beyond the treatment zone.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas and all practical measures will be taken to minimize adverse impacts to wetlands.

TABLE 4-11B
ALTERNATIVE GW-3 (PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE AND MONITORING WITH INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	The design specifications and required construction procedures would ensure that Alternative GW-3 will comply with this ARAR for all areas within the 100-year floodplain.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	The design specifications and required construction procedures would ensure that Alternative GW-3 will comply with this ARAR for all work areas within the 100-foot buffer zone of a wetland to minimize impacts to wetlands and mitigate if necessary.

TABLE 4-11C
ALTERNATIVE GW-3 (PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Will be attained. Alternative GW-3 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 190 ug/L	Will be attained. Alternative GW-3 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Alternative GW-3 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Ground Water Discharge Permit Program (314 CMR 5.00)	Relevant and Appropriate	Groundwater discharges shall not result in a violation of Massachusetts Surface Water Quality Standards (314 CMR 4.00) or Massachusetts Ground Water Quality Standards (314 CMR 6.00).	Will be attained. Alternative GW-3 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures will ensure that Alternative GW-3 would comply with this ARAR to minimize fugitive dust and particulate emissions during construction.

TABLE 4-11C (cont.)
ALTERNATIVE GW-3 (PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-11D
DETAILED ANALYSIS OF ALTERNATIVE GW-3
PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE
AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic, benzene, trichloroethene (TCE), and/or 1,2-dichloroethane (DCA) in groundwater within the Northern Study Area by a construction worker, industrial worker, and car wash worker. This alternative would include the extraction of groundwater from the human health risk area (Figure 2-4), treatment of groundwater to remove organic and inorganic contaminants, and discharge of treatment system effluent back to the environment. Due to the presence of arsenic in soils located throughout the Northern Study Area, arsenic in groundwater would be expected to be persistent and extraction/treatment of groundwater would not be expected to reduce contaminant levels to below the remediation goals in the foreseeable future. Therefore, the protection of human health that would be provided by this alternative would result from the imposition of institutional controls that are placed on properties located within the contaminated area (Figure 2-4) to regulate or prohibit groundwater uses that might present hazardous exposures. As a result, the overall protection of human health that would be provided by this alternative would be limited to the extent that these institutional controls can be adequately enforced.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to groundwater. However, the fate and transport evaluation for the Northern Study Area indicates that groundwater is providing a continuing source of contamination to sediment in the HBHA Pond, which contributes to unacceptable risks to benthic communities in the Pond. Contaminants are believed to enter Pond sediments via groundwater discharges to the northern half of the eastern side of the HBHA Pond. Under this alternative, groundwater that flows toward the Pond, and ultimately discharges into the Pond, would be intercepted by the extraction well network and treated to remove contaminants. By decreasing the volume of contaminants discharging to the Pond, this alternative would protect ecological receptors in the HBHA Pond by preventing further degradation in sediment and surface water quality in the Pond.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with chemical-specific ARARs that are identified on Table 4-11C.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-11B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-11A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for groundwater that were established based on human health and ecological risk assessment guidance, so long as the institutional controls are enforced.

TABLE 4-11D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-3
PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE
AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual human health risk that would result from the selection of this alternative would be moderate since contaminant levels in the human health risk area would not be expected to decrease sufficiently to allow for unrestricted use of groundwater. Therefore, human health protection would be dependent upon the enforcement of institutional controls to prevent groundwater uses that would result in unacceptable human health risks. This alternative would prevent the discharge of contaminated groundwater into the HBHA Pond, which would eliminate an existing source of contaminants to sediment and surface water that presents ecological risk to benthic communities in the Pond. However, unless a remedial alternative is implemented in the HBHA Pond to reduce or eliminate contaminants in sediment and surface water, residual ecological risks would remain in the Pond. Due to the fact that contaminants levels will remain at the site above levels which permit unlimited exposure and unrestricted use, five-year reviews would be required to periodically evaluate risks associated with on-site contamination until remediation goals are achieved.
Adequacy and Reliability of Controls	The ex-situ treatment technologies that would be used to decrease concentrations of contaminants in groundwater would be able to meet the required process efficiencies and performance specifications. Long-term management of the treatment system components would be required, which would require considerable effort. Operations and maintenance would include daily process control activities, maintenance of extraction wells and treatment equipment, periodic system inspections to perform preventative maintenance, change-out or regeneration of treatment media, and process water sampling to verify treatment system effectiveness. Long-term monitoring of groundwater would be required to periodically evaluate contaminant levels in the aquifer and to verify the effectiveness of the extraction and treatment systems. Technical components may need to be periodically replaced, but replacement of technical components would not likely create unacceptable threats or risks. Institutional controls would be imposed on properties within the contaminated groundwater plume to prevent exposures to contaminated groundwater during the treatment period.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	The treatment processes that would be employed would address the principal threats (arsenic, benzene, toluene, TCE, naphthalene and 1,2-DCA).
Amount of Hazardous Materials Destroyed or Treated	Influent groundwater to the ex-situ treatment system would be treated to remove contaminants so that effluent contains concentrations of contaminants that are below remediation goals.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	The toxicity, mobility, and volume of contaminants in groundwater would be reduced under this alternative to levels that correspond to human health risks within an acceptable risk range.

TABLE 4-11D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-3
PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE
AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	Groundwater treatment would be irreversible. Contaminants would be permanently removed from the aqueous waste stream.
Type and Quantity of Residuals Remaining After Treatment	Residual concentrations of contaminants would remain in treated groundwater, but at levels below remediation goals. This water would be discharged to the environment.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Potential risks to the community during implementation include exposure to contaminants during well installation, pipe installation, or building construction. These risks would be addressed through the use of conventional health and safety procedures, decontamination procedures to prevent the spread of contaminants, and other engineering controls designed to prevent physical hazards associated with construction. There would be no risks that could not be adequately controlled using some type of engineering control.
Protection of Workers During Remedial Actions	Risks to workers that would be addressed during implementation include potential exposure to contaminants during construction of the extraction and treatment system. These risks would be adequately controlled through the use of health and safety and decontamination procedures. Physical hazards associated with construction activities would be adequately controlled using engineering controls.
Environmental Impacts	No adverse impacts to the environment would result from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	Remedial action objectives for the protection of human health would be achieved through the implementation of institutional controls on the properties where potential future risks were identified by preventing activities that would present risks from future exposures to groundwater. This could be accomplished shortly after selection of the remedy. The remedial action objectives for the protection of the environment would be achieved as soon as the groundwater extraction/treatment system is constructed and is shown to be intercepting contaminated groundwater before it discharges to the HBHA Pond. Construction of the groundwater extraction/treatment system would take approximately six months to complete. Site-wide groundwater contaminant concentrations would not likely be reduced to the remediation goals within the foreseeable future, since no source control would be conducted and continuing sources of arsenic contamination to groundwater will remain at the site.

TABLE 4-11D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-3
PLUME INTERCEPT BY GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE
AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	Some difficulties may be encountered during construction, including the installation of pipes below the railroad tracks located to the west of the HBHA Pond where sensitive utility pipelines are present and the water table is located within 2 feet of the ground surface. However, construction of an extraction system adequate to contain and capture the groundwater contamination plume would ultimately be feasible.
Reliability of the Technology	Groundwater extraction and treatment is a well-developed technology, and significant delays are not likely to result from technical problems during construction.
Ease of Undertaking Additional Remedial Actions, if Necessary	No future remedial actions would be anticipated. If necessary, additional remedial actions could be taken without difficulty.
Ability to Monitor Effectiveness of Remedy	Process monitoring and groundwater monitoring could be used to evaluate the effectiveness of the remedy. Surface water and sediment monitoring would be performed under other remedial actions at the site. There would be no exposure pathways that could not be adequately monitored.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Off-site treatment and/or disposal would be required for sludges that accumulate in the clarifier. Off-site treatment and/or disposal capacity for the anticipated volume of material would be available.
Availability of Necessary Equipment and Specialists	The equipment and technical specialists required to implement this alternative would be readily available from several sources.
Availability of Prospective Technologies	The technologies that are under consideration are generally available and sufficiently demonstrated for groundwater treatment. These technologies are currently available for full-scale use.
7. Cost	
Capital Costs	$4,739,000
Operations and Maintenance Costs	$1,297,000/year (Years 1 and 2) $1,040,000/year (Years 3 through 30)
Present Worth Costs	$19,137,000

TABLE 4-12A
ALTERNATIVE GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	GW-4 would comply with this ARAR. Groundwater monitoring would be required to evaluate the performance of in-situ groundwater technologies and contaminant migration into HBHA Pond.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative method that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts to wetlands.

TABLE 4-12B
ALTERNATIVE GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	The design specifications and required construction procedures would ensure that Alternative GW-4 will comply with this ARAR for all areas within the 100-year floodplain.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	The design specifications and required construction procedures would ensure that Alternative GW-4 will comply with this ARAR for all work areas within the 100-foot buffer zone of a wetland to minimize impacts to wetlands and mitigate if necessary.

TABLE 4-12C
ALTERNATIVE GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 190 ug/L	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Ground Water Discharge Permit Program (314 CMR 5.00)	Relevant and Appropriate	Groundwater discharges shall not result in a violation of Massachusetts Surface Water Quality Standards (314 CMR 4.00) or Massachusetts Ground Water Quality Standards (314 CMR 6.00).	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards designate and assign uses for which groundwater in the Commonwealth shall be managed and protected, and set forth water quality criteria necessary to maintain the designated areas.	Will be attained. Alternative GW-4 will provide in situ treatment of organic contamination to the north of the West Hide Pile until these standards are achieved.

TABLE 4-12C (cont.)
ALTERNATIVE GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures will ensure that GW-4 will comply with this ARAR to minimize fugitive dust and particulate emissions during construction.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-12D
DETAILED ANALYSIS OF ALTERNATIVE GW-4
PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic, benzene, trichloroethene (TCE), and/or 1,2-dichloroethane (DCA) in groundwater within the Northern Study Area by a construction worker, industrial worker, and car wash worker. This alternative would protect human health by treating groundwater to destroy organic contaminants (enhanced bioremediation) and by imposing institutional controls on properties located within the groundwater contamination area to prevent future exposures that would present unacceptable human health risks. Potential human health risks due to exposure to arsenic in groundwater would not be mitigated by this alternative, since treatment for arsenic would only occur within the permeable reactive barrier. Groundwater located upgradient from the barrier would not be remediated, and protection of human health in these areas would be dependent upon adequate enforcement of institutional controls designed to prevent exposure to contaminated groundwater.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to groundwater. However, the fate and transport evaluation for the Northern Study Area indicates that groundwater is providing a continuing source of contamination to sediment in the HBHA Pond, which contributes to unacceptable risks to benthic communities in the Pond. Contaminants are believed to enter Pond sediments via groundwater discharges to the northern half of the eastern side of the HBHA Pond. Under this alternative, groundwater that flows toward the Pond, and ultimately discharges into the Pond, would be treated using in-situ treatment technologies (permeable reactive barrier and enhanced bioremediation) prior to discharge to the Pond, therefore reducing the contaminant load that discharges to the Pond.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the chemical-specific ARARs that are identified on Table 4-12C.
Location-Specific ARARs	This alternative would comply with all of the pertinent location-specific ARARs that are identified on Table 4-11B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are identified on Table 4-11A.
Other Criteria, Advisories, and Guidance	This alternative will comply with the PRGs for groundwater that were established based on human health and ecological risk assessment guidance, so long as the institutional controls are enforced.

TABLE 4-12D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-4
PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual human health risk that would result from the selection of this alternative would be moderate since contaminant levels in the human health risk area would not be expected to decrease sufficiently to allow for unrestricted use of groundwater (arsenic would not be treated in this area). Therefore, human health protection would be dependent upon the enforcement of institutional controls to prevent future exposures to groundwater that would result in unacceptable human health risks. This alternative would prevent the discharge of contaminated groundwater into the HBHA Pond, which would eliminate an existing source of contaminants to sediment and surface water that presents ecological risk to benthic communities in the Pond. However, unless a remedial alternative is implemented in the HBHA Pond to reduce or eliminate contaminants in sediment and surface water, residual ecological risks would remain in the Pond. Due to the fact that contaminants levels will remain at the site above levels which permit unlimited exposure and unrestricted use, five-year reviews would be required to periodically evaluate risks associated with on-site contamination until remediation goals are achieved.
Adequacy and Reliability of Controls	Long-term management of the reactive barrier would be required, which would require considerable effort. Operations and maintenance for in-situ treatment would include periodic changeout of reactive media in the barrier, and potentially additional subsurface injections of oxidant if it is determined to be required to meet remediation goals. Long-term monitoring of groundwater would be required to periodically evaluate contaminant levels in the aquifer and to evaluate progress toward meeting remedial objectives.
Adequacy and Reliability of Controls (continued)	Technical components, such as treatment media in the reactive barrier, may need to be periodically replaced if it becomes clogged or fouled. Replacement of technical components would not likely create unacceptable threats or risks. Institutional controls would be imposed on properties within the contaminated groundwater plume to prevent exposures to contaminated groundwater. These controls would be adequate and reliable to prevent hazardous exposures to groundwater.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	The treatment processes that would be employed would address the principal threats (arsenic, benzene, toluene, TCE, naphthalene, and 1,2-DCA). Enhanced bioremediation through the injection of an oxygen-producing slurry would be utilized to promote biodegradation of organic contaminants in the benzene/toluene source areas (near Atlantic Avenue and below the West Hide Pile). A permeable reactive barrier would be utilized to intercept groundwater prior to discharge into the HBHA Pond and remove arsenic from groundwater.
Amount of Hazardous Materials Destroyed or Treated	Groundwater would be treated to destroy or treat contaminants with the goal of decreasing their concentrations to levels that are below remediation goals.

TABLE 4-12D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-4
PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree of Expected Reductions in Toxicity, Mobility, and Volume	The toxicity, mobility, and volume of organic and inorganic contaminants in groundwater would be reduced under this alternative.
Degree to Which Treatment is Irreversible	Enhanced bioremediation would be irreversible, since organic contaminants would be destroyed or converted into non-toxic residuals. Treatment of arsenic-contaminated groundwater using a permeable reactive barrier may be reversible since arsenic is not destroyed, but converted into a less toxic form that is not removed from the environment.
Type and Quantity of Residuals Remaining After Treatment	Residual concentrations of contaminants would remain in groundwater during the implementation of the alternative. Arsenic in groundwater located upgradient from the reactive barrier would not be treated, therefore high levels of residual contamination would remain.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Potential risks to the community during implementation include exposure to contaminants during construction. These risks would be addressed through the use of conventional health and safety procedures and decontamination procedures to prevent the spread of contaminants. There would be no risks that could not be adequately controlled using some type of engineering control.
Protection of Workers During Remedial Actions	Risks to workers that would be addressed during implementation include potential exposure to contaminants during construction of the barrier or installation of oxygen injection points. These risks would be adequately controlled through the use of health and safety and decontamination procedures. Physical hazards associated with construction activities would be adequately controlled using engineering controls.
Environmental Impacts	Environmental impacts from the implementation of in-situ groundwater technologies would be expected to be minimal. The construction of the barrier would occur within the 100-year floodplain, and measures would need to be taken to minimize impacts from construction in the floodplain.
Time Until Remedial Action Objectives are Achieved	Remedial action objectives for the protection of human health will be achieved through the imposition of institutional controls on the properties where potential future exposures to contaminated groundwater were identified. This could be accomplished shortly after remedy selection. Achievement of RAOs for the protection of human health would be contingent on the enforcement of institutional controls, since the in-situ treatment process (PRB) proposed under this alternative for the treatment of arsenic would not be capable of reducing concentrations of arsenic in groundwater in the areas where potential future risks were identified. Remedial action objectives for the protection of the environment would be achieved to the extent that in-situ oxidation treatment for the removal of benzene in groundwater is effective to reduce benzene concentrations in groundwater that discharges to the HBHA Pond. The PRB would prevent arsenic transport into the Pond via groundwater discharges, but would not prevent the transport of organic contaminants into the Pond via groundwater discharge.

TABLE 4-12D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-4
PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	Some uncertainty exists as to the potential effectiveness of an in-situ treatment technology that relies upon a liquid delivery system (i.e. in-situ enhanced bioremediation) to treat groundwater. The ability to apply the reagent to the subsurface in a manner that permits adequate contact with the entire volume of contaminated groundwater to achieve treatment goals is uncertain. Construction uncertainties exist with the installation of a PRB of the size required to intercept contaminated groundwater before it discharges to the HBHA Pond. Technologies have been developed that enable the construction of PRBs to the depth required, but these technologies are not routine.
Reliability of the Technology	There is some question as to the effectiveness of a PRB at the Site given the groundwater chemistry (high dissolved organic carbon, high dissolved solids) at the Site. These characteristics have been shown to adversely impact the performance of ZVI-based PRBs. Technical problems associated with the ability to treat benzene contamination using an in-situ reagent delivery system may lead to schedule delays.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be undertaken, if necessary, but the presence of a reactive barrier could complicate future remedial efforts, particularly if they require removal of the barrier to perform remedial actions.
Ability to Monitor Effectiveness of Remedy	No exposure pathways would exist that could not be adequately monitored.
Ability to Obtain Approvals from Other Agencies	No approvals from other agencies would be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	The equipment and technical specialists required to design and construct a permeable reactive barrier would be limited. The equipment and technical specialists required to design and implement an enhanced bioremediation remedial action would be available from several sources.
Availability of Prospective Technologies	The technologies that are under consideration are generally available and sufficiently demonstrated for groundwater treatment. These technologies are currently available for full-scale use.

TABLE 4-12D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE GW-4
PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
7. Cost	
Capital Costs	$13,089,000
Operations and Maintenance Costs	$444,000/year (Years 1 through 5) $222,000/year (Years 6 through 30)
Present Worth Costs	$17,792,000

TABLE 4-13A
ALTERNATIVE HBHA-1 (NO ACTION) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no action-specific ARARs for Alternative HBHA-1.	No action would be taken under alternative HBHA-1 that would invoke an action-specific ARAR.

TABLE 4-13B
ALTERNATIVE HBHA-1 (NO ACTION) - LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative HBHA-1.	No action would be taken under Alternative HBHA-1 that would invoke a location-specific ARAR.

TABLE 4-13C
ALTERNATIVE HBHA-1 (NO ACTION) - CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	Since no actions will be taken, the NRWQC for arsenic, benzene, and other site-related constituents would be not be attained. Contaminated sediments would continue to degrade surface water quality.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-13D
DETAILED ANALYSIS OF ALTERNATIVE HBHA-1
NO ACTION – HALLS BROOK HOLDING AREA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risks from sediment in the HBHA Pond. Therefore, despite the fact that this alternative takes no action to contain, remove, or treat contamination, no unacceptable human health risks would result from the implementation of this alternative.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to contaminants in sediment. Since this alternative takes no action to contain, remove, or treat contaminated sediments in the pond unacceptable risks to ecological receptors will remain from the HBHA Pond sediments.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with the chemical-specific ARARs identified on Table 4-13C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	Since there are no actions associated with this alternative, there are no action-specific ARARs identified.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for HBHA Pond sediment that were established based on ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of ecological residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate ecological exposures to HBHA Pond sediment. The source of this risk would be the contaminated sediment load that is currently located at the bottom of the Pond. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken to contain, remove, or treat sediment in the HBHA Pond under this alternative, no provisions would be taken to control ecological exposures. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.

TABLE 4-13D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-1
NO ACTION – HALLS BROOK HOLDING AREA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for sediment would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment or construction technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in HBHA Pond sediment.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.

TABLE 4-13D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-1
NO ACTION – HALLS BROOK HOLDING AREA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-14A
ALTERNATIVE HBHA-2 (MONITORING) - ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no action-specific ARARs for Alternative HBHA-2.	No action would be taken under Alternative HBHA-2 that would invoke an action-specific ARAR.

TABLE 4-14B
ALTERNATIVE HBHA-2 (MONITORING) - LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Alternative HBHA-2.	There are no actions that would be performed that would invoke a location-specific ARAR.

TABLE 4-14C
ALTERNATIVE HBHA-2 (MONITORING) - CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative that will address groundwater contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater contaminant sources.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-14D
DETAILED ANALYSIS OF ALTERNATIVE HBHA-2
MONITORING – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from sediment in the HBHA Pond. Therefore, despite the fact that this alternative takes no action to contain, remove, or treat contamination, no unacceptable human health risks would result in the HBHA Pond from implementation of this alternative. This alternative would take no measures to prevent the downstream transport of contaminated sediment that originates from the HBHA Pond. Potential human health risks may be created in the future if no actions are taken to eliminate this sediment transport mechanism.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to contaminants in sediment. Since this alternative takes no action to contain, remove, or treat contaminated sediments in the pond unacceptable risks to ecological receptors will remain from the HBHA Pond sediments. The fate and transport evaluation for the site indicates that the source of contaminants (arsenic and benzene) to sediment in the northern portion of the HBHA Pond is the groundwater that discharges into this portion of the Pond. If no actions are taken to remediate groundwater upgradient from the Pond, the transport of these contaminants into the Pond's sediments will continue indefinitely, and the rate of natural contaminant degradation is not likely to be adequate to decrease contaminant concentrations in HBHA Pond sediment to levels that eliminate risks to ecological receptors. If groundwater located upgradient from the Pond is treated to remove arsenic and benzene, the chemical makeup of groundwater that discharges to the Pond will be altered, potentially impacting the existing chemical profile in the Pond and mobilizing sediment that is currently sequestered at the base of the Pond. Potential ecological and/or human health risks may develop from the transport of HBHA Pond to downstream depositional areas.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with the chemical-specific ARARs that are presented on Table 4-14C.
Location-Specific ARARs	Since there are no on-site actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	Since there are no on-site actions associated with this alternative, there are no action-specific ARARs identified.
Other Criteria, Advisories, and Guidance	This alternative may eventually comply with the PRGs established based on human health and ecological risk assessment guidance assuming groundwater sources are removed.

TABLE 4-14D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-2
MONITORING – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be high since no on-site actions would be taken to treat, contain, or remove contaminated sediment in the HBHA Pond. The collection of samples would be utilized to continually evaluate the progress (if any) toward achieving RAOs. In the meantime, untreated residual contamination would be a source of risk to ecological receptors. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with sediment contamination in the HBHA Pond.
Adequacy and Reliability of Controls	The only technologies that would be utilized under this alternative are sampling and analysis techniques that would be used to periodically evaluate the rate of natural contaminant degradation (if any). These monitoring techniques would be able to meet the performance goals required to adequately monitor the remedy. Since no treatment, containment, or removal of HBHA Pond sediments would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic collection of sediment and surface water samples from the Pond to evaluate risks.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative would not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions (other than the collection of environmental samples) would be taken.
Protection of Workers During Remedial Actions	Potential impacts to workers during sediment monitoring could be mitigated through the use of adequate health and safety procedures, including personal protective equipment and decontamination facilities.
Environmental Impacts	Impacts to the environment from the monitoring activities that would be conducted under this alternative would be minimal.

TABLE 4-14D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-2
MONITORING – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Time Until Remedial Action Objectives are Achieved	If no groundwater treatment is conducted upgradient from the HBHA Pond, the time frame for the achievement of remedial objectives would be very long. Treatment of groundwater that discharges to the Pond may reduce the time frame for recovery, but not to within an acceptable time frame.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no on-site construction activities would be undertaken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions (containment, removal, and/or treatment) would be necessary since natural recovery is not likely to be adequate to achieve RAOs. Additional remedial actions could easily be implemented.
Ability to Monitor Effectiveness of Remedy	Monitoring would be used to evaluate the degree of natural recovery that is occurring in sediment. No migration or exposure pathways exist that cannot by monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$141,000/yrs 1-2; $70,000/yrs 3-30
Present Worth Costs	$1,201,000

TABLE 4-15A
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts to floodplains.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained because (a) there is no practical alternative cap placement method that would achieve the remedial objective with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-15A (cont.)
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS
PAGE 2 OF 3

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative HBHA-3 would comply with this ARAR. Design specifications for the placement of cap materials and design of the dewatering treatment system would ensure that HBHA-3 would comply with applicable standards.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative cap placement method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges will be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank will be restored.
	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.

TABLE 4-15A (cont.)
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; Stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative cap placement method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Placement of fill (cap) materials is allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-15B
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts to floodplains.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative HBHA-3 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities 40 CFR 264.18(b)	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative HBHA-3 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-15B (cont.)
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative cap placement method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges will be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank will be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative cap placement method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Placement of fill (cap) materials allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-15C
ALTERNATIVE HBHA-3 (SUBAQUEOUS CAP)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative HBHA-3 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-3 would comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	NRWQC for arsenic and other site-related constituents will be achieved once the source of contaminated groundwater discharges are eliminated.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-15D
DETAILED ANALYSIS OF ALTERNATIVE HBHA-3
SUBAQUEOUS CAP – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from sediment in the HBHA Pond. No human health risks would result from the implementation of this alternative. The installation of a subaqueous cap in the HBHA Pond would reduce or eliminate the transport pathway that is currently enabling the mobilization of contaminated sediment from the Pond to downstream depositional areas. Prevention of sediment transport would prevent the potential for future human health risks resulting from downstream deposition of contaminated sediment originating from the HBHA Pond.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to contaminants in sediment. This alternative would involve the installation of a subaqueous cap of adequate thickness to prevent contact by ecological receptors with contaminated sediment in the Pond. The subaqueous cap would also provide a new habitat for benthic communities. The fate and transport evaluation for the site indicates that the source of contaminants (arsenic and benzene) to sediment in the northern portion of the HBHA Pond is the groundwater that discharges into this portion of the Pond. If no actions are taken to remediate groundwater upgradient from the Pond, the transport of these contaminants into the Pond's sediments will continue indefinitely, and recontamination of the subaqueous cap materials is likely. If groundwater located upgradient from the Pond is treated to remove arsenic and benzene, the subaqueous cap will be more protective of the environment since there will not be a continuing source of contaminants that could impact the protectiveness of the cap.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the pertinent chemical-specific ARARs that are presented on Table 4-15C.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs that are presented on Table 4-15B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs that are presented on Table 4-15A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for HBHA Pond sediment that were established based on ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual ecological risk that would result from the implementation of this alternative would be low since the subaqueous cap would prevent ecological exposures to contaminated sediment in the HBHA Pond. Any potential sources of ecological risk would be due to the presence of untreated sediment that would remain in the Pond that might be exposed through erosion or disruption of the cap materials. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with sediment contamination in the HBHA Pond.

TABLE 4-15D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-3
SUBAQUEOUS CAP – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	In order to verify the effectiveness of the subaqueous cap at preventing ecological exposures to contaminated sediment, an intense long-term maintenance and monitoring program would need to be implemented. The types of functions that would need to be performed are likely to include pond bottom elevation measurements to verify that adequate cap thickness is retained under the stresses created by currents and bioturbation, and sample collection to verify that the clean capping materials are not being contaminated by the underlying sediments, new sediment depositions from upstream sources, or groundwater discharges to the pond. If monitoring suggests that the subaqueous cap is not adequate to protect ecological receptors, additional cap material would need to be placed in the areas where excessive erosion has adversely impacted the cap's performance. If failures/weaknesses in the cap develop, high level ecological risks will result until these areas are repaired or replaced.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Potential impacts to the community during implementation of this alternative would include increased truck traffic that would be necessary to import clean capping materials and the potential spread of contamination to areas outside of the exclusion zone. These potential impacts could be mitigated or eliminated through the development of traffic and noise mitigation plans and the use of decontamination procedures to prevent the spread of contaminants.
Protection of Workers During Remedial Actions	Potential risks to workers during the construction of the cap would include physical hazards associated with underwater construction (hypothermia, drowning, etc.) and exposure to contaminants. Health and safety measures, decontamination facilities, and other engineering controls could be used to mitigate or eliminate these potential risks. There would be no risks to workers that could not be readily controlled.

TABLE 4-15D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-3
SUBAQUEOUS CAP – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Environmental Impacts	Impacts to the environment from the construction of a subaqueous cap would be extensive. In order to place cap materials onto the Pond bottom without resuspending contaminated sediment into the water column, the Pond would be dewatered so that materials could be placed while the Pond bottom is dry. Placement of a cap over the existing pond bottom would also virtually destroy the existing aquatic habitat in the Pond. Any destruction of habitat from the placement of cap materials would likely be short term in nature, as new habitats would be provided by the placement of clean substrate material selected to facilitate the redevelopment of benthic communities in the Pond.
Time Until Remedial Action Objectives are Achieved	The anticipated duration of construction activities required to construct a subaqueous cap over sediments in the HBHA Pond would be 6 months. After this time period, RAOs for the protection of the environment in the Pond would be achieved.
6. Implementability	
Ability to Construct and Operate the Technology	The sediment that is located at the bottom of the HBHA Pond is a black muck consisting of high organic content, low percent solids material that has been described as “black ooze”. This material would not provide a very good substrate upon which to place subaqueous cap materials. During placement of the subaqueous cap, it is very likely that the black ooze would be displaced and contaminated sediment would be resuspended into the overlying water column. Therefore, the evaluation of this alternative for the FS assumed that the Pond would need to be dewatered prior to placement of the subaqueous cap materials. This process would place the implementability of this alternative in question due to the size of the Pond and the volume of water that would need to be pumped out of the Pond to effectively place the cap materials.
Reliability of the Technology	The subaqueous capping technology is somewhat reliable (assuming that the sediment upon which the cap is placed is capable of supporting the cap materials), but potential issues and uncertainties during cap placement could cause delays in construction.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions may be necessary if the subaqueous cap is proven to be ineffective at preventing ecological exposures to contaminated sediment. The implementation of additional remedial actions would be complicated by the extra sediment material that would be placed to construct the subaqueous cap.
Ability to Monitor Effectiveness of Remedy	Sediment and surface water monitoring would be used to evaluate the effectiveness of the subaqueous cap. Pond bottom surveys might also be used to assess the degree to which cap materials have eroded, exposing the underlying contamination. These types of monitoring activities are relatively difficult to implement.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.

TABLE 4-15D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-3
SUBAQUEOUS CAP – HALLS BROOK HOLDING AREA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Necessary Equipment and Specialists	The equipment and technical specialists required to construct a subaqueous cap would be available.
Availability of Prospective Technologies	Full-scale applications using a subaqueous cap have been utilized to contain sediments and/or prevent direct contact with contaminated sediments at more than 12 Superfund sites.
7. Cost	
Capital Costs	$3,160,000
Operations and Maintenance Costs	$144,000/year
Present Worth Costs	$5,291,000

TABLE 4-16A
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained because (a) there is no practical alternative that will achieve the cleanup objective with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved. Appropriate mitigation would be included to compensate for the continuing deposition of contaminants into the northern portion of HBHA Pond and to compensate for the portions of the New Boston Street Drainway (that were not accounted for in the original 1986 remedy decision) where an impermeable cap would be installed. These actions would be required to replace lost and impaired functions and values.

TABLE 4-16A (cont.)
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT
RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J	Applicable	Subpart A of Part 262 provides that a generator who treats, stores, or disposes of hazardous waste on-site must determine whether or not he has a hazardous waste, obtain an EPA identification number for any hazardous waste and comply with the regulations regarding accumulation of hazardous waste and recordkeeping. Subparts I and J of Part 264 identify design, operating, monitoring, closure, and post-closure care requirements for long-term storage of RCRA hazardous waste in containers and tank systems, respectively. However, Section 262.34(a) allows accumulation of RCRA hazardous wastes for up to 90 days in containers or tanks provided generator complies with requirements of Subparts I and J of Part 265.	Will be attained. Any free product, drums, or contaminated equipment would be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations would also be complied with for any off-site disposal.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criteria to determine whether they should be managed as hazardous waste.

TABLE 4-16A (cont.)
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT
RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated sediments constitute characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	Contaminated sediments in the HBHA Pond are the result of the discharge of contaminated groundwater. Periodic dredging of the sediments north of the cofferdam will remove unacceptable risks to human health and the environment beyond the point of compliance, south of the cofferdam.
	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative HBHA-4 will comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-4 will comply with applicable standards.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-4 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-16A (cont.)
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT
RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond will be required to replace lost and impaired functions and values.
	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-16A (cont.)
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT
RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Mass. Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Applicable	Section 30.300 identifies the requirements for disposal of hazardous waste; Sections 30.680 and 30.690 identify requirements for long-term storage of RCRA hazardous waste in containers and tank systems similar to federal RCRA storage requirements identified above. Section 30.340 allows on-site accumulation of hazardous waste for up to 90 days and is also similar to federal RCRA storage requirements identified above.	See discussion of federal RCRA Hazardous Waste Regulations above.

TABLE 4-16B
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative HBHA-4 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities 40 CFR 264.18(b)	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative HBHA-4 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-4 will comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-16B (cont.)
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-16C
ALTERNATIVE HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	HBHA-4 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-4 would comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	AWQC for arsenic and other site-related constituents would be achieved at the point of compliance (south of the HBHA cofferdam) and in the river downstream of the cofferdam.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-16D
DETAILED ANALYSIS OF ALTERNATIVE HBHA-4
STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING ALTERNATE HABITAT
HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from sediment in the HBHA Pond. No human health risks would result from the implementation of this alternative. The partial removal of contaminated sediment from the HBHA Pond, prevention of stormwater flows that serve to resuspend sediment in the northern portion of the HBHA Pond, and retention of suspended sediment in the northern portion of the Pond would eliminate the transport pathway that is currently enabling the mobilization of contaminated sediment from the Pond to downstream depositional areas. Prevention of sediment transport would prevent the potential for future human health risks resulting from downstream deposition of contaminated sediment originating from the HBHA Pond.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to contaminants in sediment. This alternative would involve the partial removal of sediment that is the source of the ecological risk and replacement of contaminated sediment with material that would provide a new ecosystem for benthic invertebrates in the Pond. In this portion of the pond, this alternative would be protective of the environment. In the northern portion of the Pond (see Figure 4-3), contaminated sediment would remain, but alterations would be made to the Pond to prevent resuspension and downstream transport of contaminated sediment. In the northern portion of the pond, ecological risks associated with contaminated sediment would remain, but an alternate habitat would be created at an off-site location to compensate for the 1-acre pond habitat that would be lost to this alternative. If groundwater located upgradient from the Pond, that currently discharges to the Pond, is not treated to remove arsenic and benzene, the protectiveness of this alternative would not be impacted, since the alternative is designed to contain contaminated sediments within the northern portion of the modified HBHA Pond.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the pertinent chemical-specific ARARs that are presented on Table 4-16C.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs that are presented on Table 4-16B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs that are presented on Table 4-16A.
Other Criteria, Advisories, and Guidance	This alternative will comply with the PRGs for HBHA Pond sediments that were established based on ecological risk assessment guidance.

TABLE 4-16D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-4
STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING ALTERNATE HABITAT
HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual ecological risk that would result from the implementation of this alternative would be moderate since sediment with concentrations of arsenic that exceed the ecological risk-based PRG for arsenic would be removed from the southern portion of the Pond and replaced with clean material. This would prevent future migration of contaminants to downstream areas that might present unacceptable human health risks in the future. Residual ecological risks would remain in the northern portion of the HBHA Pond, since no contaminated sediment removal would be performed. The modifications to the Pond would prevent the migration of contaminated sediment from the northern portion of the Pond, so potential human health or ecological risks in downstream areas resulting from contamination in the HBHA Pond would be eliminated. Residual risks from contaminated groundwater discharges to the Pond would be minimal since modifications to the HBHA Pond would prevent contaminated sediment from migrating to downstream areas. Arsenic and benzene contamination that enters the Pond via groundwater discharge would continue to be sequestered by the geochemistry of the Pond, but would be prevented from transport. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required for the HBHA Pond sediments.
Adequacy and Reliability of Controls	Hydraulic dredging is a well developed technology for the removal of sediment from the bottom of surface water bodies. GPS technology can be used to ensure that the entire Pond bottom is dredged. The hydraulic dredging technology results in very little suspended sediment during dredging operations. The surface water controls that are proposed under this alternative could be constructed to contain sediments within the northern portion of the Pond. Considerable long-term management and monitoring would be required to verify the effectiveness of this alternative. The types of activities that would be conducted include periodic inspection and maintenance of surface water controls, periodic removal of captured sediment at the base of containment structures at the southern edge of the sediment containment area, sediment and surface water sampling in the Pond, and periodic dredging of contaminated sediment that accumulates in the northern portion of the HBHA Pond from groundwater discharge and contaminant precipitation. Replacement of components may be required after a period of time if erosion or other surface water flow forces compromise the integrity of dam or other flow-control structures. If sediment containment measures were to fail because of the above-mentioned forces, short-term releases of contaminated sediment could result, impacting the southern portion of the Pond and potentially the Halls Brook Holding Area. Flow controls and O&M procedures would be designed to prevent releases of contaminated sediment.

TABLE 4-16D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-4
STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING ALTERNATE HABITAT
HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative involves the construction of flow control structures in the northern portion of the Pond that would essentially create a sedimentation basin that will promote sediment deposition in this portion of the Pond so that it does not migrate to downstream portions of the Site. Dewatering effluent that accumulates from dredged sediment would need to be treated to remove contaminants prior to returning it to the environment. A sand filter would be used to remove arsenic from liquids.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed under this alternative. Hazardous materials would be removed from surface water or dewatering effluent, but not destroyed.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	The mobility of contaminants in sediment in the northern portion of the pond would be reduced through the construction of surface water flow controls. Dewatering effluent would be treated so that contaminant levels are suitable for discharge back to the environment.
Degree to Which Treatment is Irreversible	The mobility of contaminated sediments could be reversible if the controls that are constructed in the northern portion of the Pond were not sufficient to restrict the migration of suspended sediment. Treatment of dewatering effluent would be irreversible, since contaminants would be removed from liquids prior to discharge back to the environment.
Type and Quantity of Residuals Remaining After Treatment	Residual contaminated sediment would accumulate at the bottom of the HBHA Pond, and would be periodically dredged and transported to an off-site disposal facility. Sand media that would be used to treat dewatering effluent would need to be regenerated or disposed of. The quantity of residuals would be dependent upon the water content of the dredged sediments.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Potential impacts to the community during implementation of this alternative would include increased truck traffic that would be necessary to provide dredging support, off-site transportation of dredged material, and surface water flow control structure construction activities. These potential impacts would be mitigated or eliminated through the development of traffic and noise mitigation plans and the use of decontamination procedures to prevent the spread of contaminants.
Protection of Workers During Remedial Actions	Potential risks to workers during the construction of the cap would include physical hazards associated with underwater construction and exposure to contaminants. Health and safety measures, decontamination facilities, and other engineering controls would be used to mitigate or eliminate these potential risks. There would be no risks to workers that could not be readily controlled.

TABLE 4-16D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-4
STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING ALTERNATE HABITAT
HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Environmental Impacts	Impacts to the environment from the dredging of sediment in the Pond would include the potential destruction of benthic communities and aquatic habitats resulting from the removal of a large volume of sediment from the bottom of the Pond. Any destruction of habitat from the dredging of sediment from the Pond would likely be short term in nature, as new habitats would likely develop in the cleaned up portions of the Pond.
Time Until Remedial Action Objectives are Achieved	RAOs for the protection of the environment would be achieved as soon as the construction and development of the alternate habitat was completed. This could take up to two years. Time frames could be longer if property acquisition for the purpose of constructing the alternate habitat becomes difficult.
6. Implementability	
Ability to Construct and Operate the Technology	Difficulties or uncertainties associated with dredging, dewatering, and off-site disposal of sediment would be minimal. Hydraulic dredging is a well-developed sediment removal technology, and dewatering facilities could easily be constructed to handle the anticipated volume of material that would be handled. No uncertainties or difficulties would be anticipated with the construction of a stormwater bypass or sediment retention system in the northern portion of the HBHA Pond.
Reliability of the Technology	Hydraulic dredging is a reliable technology that would use GPS to ensure that the entire contaminated area is addressed. No delays would be expected from technical problems other than those typically associated with large-scale dredging projects. No technical problems would be anticipated from the construction of a stormwater bypass and sediment retention system in the HBHA Pond beyond those typically associated with construction in an aquatic environment.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if stormwater bypass/sediment retention is not adequate to prevent downstream migration of contaminants. Additional remedial actions could be implemented rather easily.
Ability to Monitor Effectiveness of Remedy	Sediment and surface water monitoring would be used to evaluate the effectiveness of the remedy. There would be no risks of exposure that could not be adequately monitored.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Capacity for off-site disposal of sediment under this alternative would be available.
Availability of Necessary Equipment and Specialists	The equipment and technical specialists required to implement this alternative would be available.

TABLE 4-16D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-4
STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING ALTERNATE HABITAT
HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Prospective Technologies	Hydraulic dredging has been sufficiently demonstrated to be effective, and is currently available for full-scale use. Several vendors would be available to provide bids on the project.
7. Cost	
Capital Costs	$4,833,000
Operations and Maintenance Costs	$144,000/year; $1,136,500 every five years for sediment dredging.
Present Worth Costs	$8,237,000

TABLE 4-17A
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection ,40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained because (a) there is no practical alternative method that would achieve the cleanup objective with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criterion to determine whether they should be managed as hazardous waste.

TABLE 4-17A (cont.)
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J	Applicable		Will be attained. Any contaminated materials or contaminated equipment would be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations would also be complied with for any off-site disposal.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-5 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.
	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative HBHA-5 will comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-5 would comply with applicable standards.

TABLE 4-17A (cont.)
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-17A (cont.)
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Mass. Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Applicable	Section 30.300 identifies the requirements for disposal of hazardous waste; Sections 30.680 and 30.690 identify requirements for long-term storage of RCRA hazardous waste in containers and tank systems similar to federal RCRA storage requirements identified above. Section 30.340 allows on-site accumulation of hazardous waste for up to 90 days and is also similar to federal RCRA storage requirements identified above.	See discussion of federal RCRA Hazardous Waste Regulations above.

TABLE 4-17B
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative HBHA-5 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities 40 CFR 264.18(b)	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative HBHA-5 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-5 will comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-17B (cont.)
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-17C
ALTERNATIVE HBHA-5 (REMOVAL AND OFF-SITE DISPOSAL)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	HBHA-5 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-5 would comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	AWQC for arsenic and other site-related constituents will be attained once the source of contaminated groundwater discharges is eliminated.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-17D
DETAILED ANALYSIS OF ALTERNATIVE HBHA-5
REMOVAL AND OFF-SITE DISPOSAL - HBHA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from sediment in the HBHA Pond. No human health risks would result from the implementation of this alternative. The removal of contaminated sediment from the HBHA Pond would eliminate the transport pathway that is currently enabling the mobilization of contaminated sediment from the Pond to downstream depositional areas. Prevention of sediment transport would prevent the potential for future human health risks resulting from downstream deposition of contaminated sediment originating from the HBHA Pond.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to contaminants in sediment. This alternative would involve the removal of sediment that is the source of the ecological risk and replacement of contaminated sediment with material that would provide a new ecosystem for benthic invertebrates in the Pond. If groundwater located upgradient from the Pond, that currently discharges to the Pond, is not treated to remove arsenic and benzene, the protectiveness of this alternative would be limited since contaminant transport to the Pond would persist and Pond sediments would be recontaminated.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the pertinent chemical-specific ARARs that are presented on Table 4-17C.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs that are presented on Table 4-17B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs that are presented on Table 4-17A.
Other Criteria, Advisories, and Guidance	This alternative will comply with the PRGs for HBHA Pond sediment that were established based on ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual ecological risk that would result from the implementation of this alternative would be low since all sediment with concentrations of arsenic that exceed the ecological risk-based PRG for arsenic would be removed from the Pond and replaced with clean material. Residual risks would remain if the groundwater that discharges to the Pond is not remediated to remove arsenic and benzene contamination that contributes to ecological risks in the Pond. Since no contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would not be required for the HBHA Pond sediments.

TABLE 4-17D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-5
REMOVAL AND OFF-SITE DISPOSAL - HBHA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	Hydraulic dredging is a well developed technology for the removal of sediment from the bottom of surface water bodies. GPS technology can be used to ensure that the entire Pond bottom is dredged. The hydraulic dredging technology results in very little suspended sediment during dredging operations. Since no sediment would remain in the Pond in excess of the ecological risk-based PRG for sediment, no long-term management or monitoring would be required for this alternative. No operation and maintenance would be required for the HBHA Pond. If groundwater located upgradient from the Pond is not treated to remove contaminants, monitoring of sediment and surface water contamination in the Pond would be required to periodically assess the level of recontamination that is occurring due to contaminant discharges to the Pond.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	Dewatering effluent that accumulates from dredged sediment would need to be treated to remove contaminants prior to returning it to the environment. A sand filter would be used to remove arsenic from liquids.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed under this alternative. Contaminants would be removed from dewatering effluent, but not destroyed.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	Dewatering effluent would be treated so that contaminant levels are suitable for discharge back to the environment.
Degree to Which Treatment is Irreversible	Treatment of dewatering effluent would be irreversible, since contaminants would be removed from liquids prior to discharge back to the environment.
Type and Quantity of Residuals Remaining After Treatment	Sand media that would be used to treat dewatering effluent would need to be regenerated or disposed of. The quantity of residuals would be dependent upon the water content of the dredged sediments.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Potential impacts to the community during implementation of this alternative would include increased truck traffic that would be necessary to provide dredging support and off-site transportation of dredged material. These potential impacts would be mitigated or eliminated through the development of traffic and noise mitigation plans and the use of decontamination procedures to prevent the spread of contaminants.
Protection of Workers During Remedial Actions	Potential risks to workers during the construction of the cap would include physical hazards associated with underwater construction and exposure to contaminants. Health and safety measures, decontamination facilities, and other engineering controls would be used to mitigate or eliminate these potential risks. There would be no risks to workers that could not be readily controlled.

TABLE 4-17D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-5
REMOVAL AND OFF-SITE DISPOSAL - HBHA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness (cont.)	
Environmental Impacts	Impacts to the environment from the dredging of sediment in the Pond would include the potential destruction of benthic communities and aquatic habitats resulting from the removal of a large volume of sediment from the bottom of the Pond. Any destruction of habitat from the dredging of sediment from the Pond would likely be short term in nature, as new habitats would be provided by the placement of clean substrate material selected to facilitate the redevelopment of benthic communities in the Pond.
Time Until Remedial Action Objectives are Achieved	The anticipated duration of construction activities required to dredge and restore the HBHA Pond would be approximately 6 months. After this time period, RAOs for the protection of the environment in the Pond would be achieved.
6. Implementability	
Ability to Construct and Operate the Technology	Difficulties or uncertainties associated with dredging, dewatering, and off-site disposal of sediment would be minimal. Hydraulic dredging is a well-developed sediment removal technology, and dewatering facilities could easily be constructed to handle the anticipated volume of material that would be handled.
Reliability of the Technology	Hydraulic dredging is a reliable technology that would use GPS to ensure that the entire contaminated area is addressed. No delays would be expected from technical problems other than those typically associated with large-scale dredging projects.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if groundwater that discharges to the HBHA Pond is not remediated, since Pond sediments would likely be recontaminated by the transport of arsenic and benzene into the Pond. Additional remedial actions could be implemented rather easily.
Ability to Monitor Effectiveness of Remedy	Sediment and surface water monitoring would be used to evaluate the effectiveness of the remedy. Pond bottom surveys might also be used to verify that the entire area of contaminated sediment has been removed.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	The capacity for the off-site disposal of sediments that would be dredged under this alternative would be readily available from several facilities.
Availability of Necessary Equipment and Specialists	The equipment and technical specialists required to implement this alternative would be available.
Availability of Prospective Technologies	Hydraulic dredging has been sufficiently demonstrated to be effective, and is currently available for full-scale use. Several vendors would be available to provide bids on the project.

TABLE 4-17D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE HBHA-5
REMOVAL AND OFF-SITE DISPOSAL - HBHA POND SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
7. Cost	
Capital Costs	$3,560,000
Operations and Maintenance Costs	$95,000/yr for years 1-3 only
Present Worth Costs	$3,810,000

TABLE 4-18A
ALTERNATIVE NS-1 (NO ACTION)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR may not be attained since contaminated sediments that are left in place may provide a source of contaminants to surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR may not be attained since contaminated sediments that are left in place may provide a source of contaminants to surface water.

TABLE 4-18B
ALTERNATIVE NS-1 (NO ACTION)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative NS-1.	No action would be taken under Alternative NS-1 that will invoke a location-specific ARAR.

TABLE 4-18C
ALTERNATIVE NS-1 (NO ACTION)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained within the meaning of the statute. EPA would need to waive this ARAR if this remedy is selected.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	This ARAR would not be attained within the meaning of the statute. EPA would need to waive this ARAR if this remedy is selected.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.

TABLE 4-18D
DETAILED ANALYSIS OF ALTERNATIVE NS-1
NO ACTION – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic and/or benzo(a)pyrene in sediment located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. Because this alternative does not take action to mitigate these risks, this alternative does not provide any protection to human health.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediment within the Wells G&H Wetland and Cranberry Bog Conservation Area. Therefore, despite the fact that no actions would be taken under this alternative, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs identified on Table 4-18C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	This alternative would not comply with action-specific ARARs identified on Table 4-18A.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs established based on human health and ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate potential future exposures to sediment located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. All of the potential risks associated with exposure to contaminants in near-shore sediment would remain. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken under this alternative, no provisions would be taken to control future exposures to sediment. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.

TABLE 4-18D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-1
NO ACTION – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for sediment at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in sediment at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.

TABLE 4-18D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-1
NO ACTION – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-19A
ALTERNATIVE NS-2 (INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.

TABLE 4-19B
ALTERNATIVE NS-2 (INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable to Alternative NS-2 (Institutional Controls).	There are no actions that would be performed that would invoke a location-specific ARAR.

TABLE 4-19C
ALTERNATIVE NS-2 (INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.

TABLE 4-19D
DETAILED ANALYSIS OF ALTERNATIVE NS-2
INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures to arsenic and benzo(a)pyrene in sediment located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. This alternative would utilize institutional controls such as deed restrictions and access controls such as fencing and signage to restrict future on-site activities that would create human exposures to contaminated near-shore sediment. The overall protection of human health that would be provided by this alternative would be limited by the extent to which these restrictions can be enforced. The overall protection of human health that would be provided by this alternative would be further limited by the accessibility of sediment in the human health risk areas.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediment at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs identified on Table 4-19C.
Location-Specific ARARs	There are no location-specific ARARs identified for this alternative.
Action-Specific ARARs	This alternative would not comply with action-specific ARARs identified on Table 4-19A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for near-shore sediment that were established based on human health risk assessment guidance, so long as institutional controls are adequately enforced.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be moderate since no on-site actions would be taken to treat, contain, or remove contaminated sediment at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. Instead, the activities conducted under this alternative would restrict future on-site activities and install barriers to prevent human access to contaminated sediment. The effectiveness of these measures would be limited to the extent that they are effective at preventing human exposures to sediment. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with on-site contamination in the Wells G&H Wetland and Cranberry Bog Conservation Area.

TABLE 4-19D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-2
INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	Since no technologies would be utilized under this alternative, no process efficiencies or performance standards would need to be met and no technical components would need to be replaced. Since no treatment, containment, or removal of contaminants would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic inspections for evidence of human contact with contaminated sediment in the human health risk areas. There is considerable uncertainty that institutional controls could adequately control potential human exposures to contaminated sediment in at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area since contamination is located in portions of these wetlands that are readily accessible to human receptors.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative.
Protection of Workers During Remedial Actions	No impacts to workers would result from the implementation of this alternative since no on-site actions that involve potential contact with contaminated sediment would be conducted.
Environmental Impacts	No impacts to the environment would result from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	Protection against potential future exposures to near-shore sediment that would be provided by the imposition of institutional controls would be achieved as soon as the appropriate legal agreements can be drafted and approved. To the extent that these controls or restrictions can be effectively enforced, this would achieve the remedial action objectives for near-shore sediment.

TABLE 4-19D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-2
INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if institutional controls do not prove to be an effective deterrent to the types of activities that would cause unacceptable exposures to contaminated sediment in the accessible portions of the Wells G&H Wetland and Cranberry Bog Conservation Area. Additional remedial actions could easily be taken if necessary.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in sediment. No migration or exposure pathways exist that cannot by monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$70,000
Operations and Maintenance Costs	$16,000
Present Worth Costs	$338,000

TABLE 4-20A
ALTERNATIVE NS-3 (MONITORING WITH INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.

TABLE 4-20B
ALTERNATIVE NS-3 (MONITORING WITH INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Alternative NS-3.	There are no actions that would be performed that would invoke a location-specific ARAR.

TABLE 4-20C
ALTERNATIVE NS-3 (MONITORING WITH INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.

TABLE 4-20D
DETAILED ANALYSIS OF ALTERNATIVE NS-3
MONITORING WITH INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future recreational exposures to arsenic and/or benzo(a)pyrene in surface sediment that is located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. This alternative would utilize institutional controls such as deed restrictions and local ordinances and access controls such as fencing and signage to restrict future on-site activities that would create exposures to contaminated subsurface soil or limit access to contaminated sediment areas. The overall protection of human health that would be provided by this alternative would be limited by the extent to which these restrictions can be enforced. The overall protection of human health that would be provided by this alternative would be further limited by the accessibility of sediment in the human health risk areas.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediment within the former Wells G&H Wetland or Cranberry Bog Conservation Area. Therefore, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs identified on Table 4-20C.
Location-Specific ARARs	There are no location-specific ARARs identified fore this alternative.
Action-Specific ARARs	This alternative would not comply with action-specific ARARs identified on Table 4-20A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for near-shore sediment that were established based on human health risk assessment guidance, so long as institutional controls are adequately enforced.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be moderate since no on-site actions would be taken to treat, contain, or remove contaminated sediment at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. Instead, the activities conducted under this alternative would restrict future on-site activities and install barriers to prevent human access to contaminated sediment. The effectiveness of these measures would be limited to the extent that they are effective at preventing human exposures to sediment. Since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with sediment contamination in the Wells G&H Wetland and Cranberry Bog Conservation Area.

TABLE 4-20D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-3
MONITORING WITH INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	The only technologies that would be utilized under this alternative are sampling and analysis techniques that would be used to periodically evaluate risks associated with contamination in near-shore sediments. These monitoring techniques would be able to meet the performance goals required to adequately monitor the remedy. Since no treatment, containment, or removal of HBHA Pond sediments would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic collection of sediment and surface water samples from the Wells G&H Wetland and Cranberry Bog Conservation Area to evaluate risks. There is considerable uncertainty that institutional controls could adequately control potential human exposures to contaminated sediment in at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area since contamination is currently located in portions of these wetlands that are readily accessible to human receptors.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions (other than the collection of environmental samples and fencing installation) would be taken.
Protection of Workers During Remedial Actions	Potential impacts to workers during sediment/surface water monitoring could be mitigated through the use of adequate health and safety procedures, including personal protective equipment and decontamination facilities.
Environmental Impacts	Impacts to the environment from the fencing installation and monitoring activities that would be conducted under this alternative would be minimal.
Time Until Remedial Action Objectives are Achieved	Protection against potential future exposures to near-shore sediment that would be provided by the imposition of institutional controls would be achieved as soon as the appropriate legal agreements can be drafted and approved. To the extent that these controls or restrictions can be effectively enforced, this would achieve the remedial action objectives for near-shore sediment.

TABLE 4-20D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-3
MONITORING WITH INSTITUTIONAL CONTROLS – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since only minor on-site construction activities (fence installation) would be undertaken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if institutional controls do not prove to be an effective deterrent to the types of activities that would cause unacceptable exposures to contaminated sediment in the accessible portions of the Wells G&H Wetland and Cranberry Bog Conservation Area. Additional remedial actions could easily be taken if necessary.
Ability to Monitor Effectiveness of Remedy	Monitoring would be used to periodically evaluate risks associated with near-shore sediments. No migration or exposure pathways exist that cannot by monitored adequately.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No specialized equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$70,000
Operations and Maintenance Costs	$135,000/year
Present Worth Costs	$1,807,000

TABLE 4-21A
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained in part because (a) there is no practical alternative method that will achieve cleanup objectives with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there would be no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criteria to determine whether they should be managed as hazardous waste.

TABLE 4-21A (cont.)
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont)	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated sediments constitute characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	Removal of sediments which represent a human health risk would attain compliance with this standard.
	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J.	Applicable	Subpart A of Part 262 provides that a generator who treats, stores, or disposes of hazardous waste on-site must determine whether or not he has a hazardous waste, obtain an EPA identification number for any hazardous waste and comply with the regulations regarding accumulation of hazardous waste and recordkeeping. Subparts I and J of Part 264 identify design, operating, monitoring, closure, and post-closure care requirements for long-term storage of RCRA hazardous waste in containers and tank systems, respectively. However, Section 262.34(a) allows accumulation of RCRA hazardous wastes for up to 90 days in containers or tanks provided generator complies with requirements of Subparts I and J of Part 265.	Will be attained. Any contaminated media which is characterized as a hazardous waste, free product, drums, or contaminated equipment will be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations will also be complied with for any off-site disposal.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative NS-4 would comply with this ARAR. Consultations with the USFWS would be made during the design phase.

TABLE 4-21A (cont.)
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative NS-4 would comply with this ARAR. Design specifications for the removal methods and procedures and design of the dewatering treatment system would ensure that NS-4 would comply with applicable standards.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Massachusetts Surface Water Quality Standards 314 CMR 4.00	Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established. Federal AWQC are to be considered in determining effluent discharge limits. Where recommended limits are not available, site-specific limits shall be developed.	Alternative NS-4 would comply with this ARAR through design and construction methods and procedures. Treatment standards and methods would be instituted for sediment dewatering effluent.

TABLE 4-21A (cont.)
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont)	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.
	Mass. Hazardous Waste Regulations (Storage of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Relevant and Appropriate	Requirements for long-term storage, transport and disposal of RCRA hazardous waste in containers and tank systems	See discussion of federal RCRA Hazardous Waste Regulations above.

TABLE 4-21B
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative NS-4 will comply with this ARAR for all areas within the 100-year floodplain.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative NS-4 will comply with this ARAR.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative NS-4 will comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-21B (cont.)
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS
PAGE 2 OF 2

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures will be taken to minimize adverse impacts on wetlands; (c) stormwater discharges will be controlled through best management practices (BMPs); (d) actions will be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank will be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-21C
ALTERNATIVE NS-4 (REMOVAL AND OFF-SITE DISPOSAL)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative NS-4 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that NS-4 will comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Applicable	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 190 ug/L	Will be attained once contaminated sediments are removed. Design of the temporary sediment dewatering treatment system would also ensure that treated effluent will comply with applicable standards.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-21D
DETAILED ANALYSIS OF ALTERNATIVE NS-4
REMOVAL AND OFF-SITE DISPOSAL – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future recreational exposures to arsenic and/or benzo(a)pyrene in surface sediment that is located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area. This alternative would protect human health by removing all sediment that contains concentrations of arsenic and/or benzo(a)pyrene that exceed the human health-based remediation goals and replacing it with clean sediment that does not present a potential human health risk.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediment within the former Wells G&H Wetland or Cranberry Bog Conservation Area. Therefore, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the pertinent chemical-specific ARARs listed in Table 4-21C.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs listed in Table 4-21B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs listed in Table 4-21A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for near-shore sediment that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	No residual risk would be present from near-shore sediment within the Wells G&H Wetland and Cranberry Bog Conservation Area after implementation of this alternative, since all surface sediment with concentrations of arsenic and/or benzo(a)pyrene exceeding human health-based remediation goals would be removed from the site and replaced with clean sediment. No remaining sources of risk would be present in near-shore sediment at the site. Since contamination would not remain in near-shore sediment above levels that allow for unlimited use and unrestricted exposure, no five-year reviews would be required to evaluate risks in near-shore sediment in the Wells G&H Wetland and Cranberry Bog Conservation Area.

TABLE 4-21D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-4
REMOVAL AND OFF-SITE DISPOSAL – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	The removal of contaminated sediment from the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area would include the collection of confirmatory samples from sediment removal areas to confirm that all remediation goals for near-shore sediment are met. This type of contaminated sediment removal is very reliable and would be expected to achieve the remedial action's performance specification with a high degree of certainty. No long-term management, monitoring, or operations and maintenance would be required for sediment located at the edges of the Wells G&H Wetland and Cranberry Bog Conservation Area under this alternative since all contaminated sediment exceeding remediation goals would be removed. This alternative would not rely on technical components to control future risks. No uncertainties would be associated with the disposal of untreated wastes that would occur under this alternative. Disposal would be at a licensed landfill that is permitted to receive wastes with the chemical constituents that are present.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	Dewatering effluent that is generated from the pre-treatment process that would be performed prior to transportation and off-site disposal of sediment would be treated to remove contaminants. No treatment would be performed on sediments under this alternative.
Amount of Hazardous Materials Destroyed or Treated	Based on the anticipated volume of sediment that would be removed under this alternative and assumed water content of approximately 50%, approximately 3,000,000 gallons of water would be generated from dewatering activities. All of this water would be treated prior to discharge back to the environment. No treatment would be performed on sediment under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	Dewatering effluent would be treated to levels that allow discharge back to the environment. No treatment of sediment would be performed under this alternative.
Degree to Which Treatment is Irreversible	Treatment of water that would be performed under this alternative would be irreversible. Contaminants would be permanently removed from dewatering effluent. No treatment of sediment would be performed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	Treatment residuals from the treatment of dewatering effluent would consist of used sand filter medium that would be regenerated or disposed of at an off-site facility. No treatment of sediment would be employed under this alternative.

TABLE 4-21D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-4
REMOVAL AND OFF-SITE DISPOSAL – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	Impacts to the community during implementation of this alternative would be minimal. A traffic control plan would be developed to minimize impacts to local traffic flow patterns in the excavation areas and to address the increased truck traffic in the area that might result from excavation and transportation of contaminated sediment. Trucks and other excavation equipment will be decontaminated before leaving work areas to prevent the spread of contaminants onto public or private roadways. There would be no short-term risks associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Protection of Workers During Remedial Actions	Impacts to workers during remedial actions would be minimal. Excavation and construction activities that would occur under this alternative would be completed in accordance with all required health and safety regulations and procedures. Air monitoring and engineering controls will be utilized to assess and minimize exposure to contaminants by workers. The appropriate personal protective equipment will be worn during implementation, and decontamination procedures would be utilized to prevent the spread of contaminants. There would be no short-term risks to workers associated with the implementation of this alternative that could not be readily controlled using some type of engineering control.
Environmental Impacts	Some impacts to the environment would result from the implementation of this alternative, since it involves excavation within a wetland area. All wetland areas that are impacted by excavation or by modifications necessary to gain access to the wetland will be restored at the completion of contaminated sediment removal activities.
Time Until Remedial Action Objectives are Achieved	The estimated duration of the construction activities that would be performed under this alternative would be 4 months. After this period of time, all threats associated with near-shore sediment at the site would be addressed and all remedial action objectives pertaining to near-shore sediment will have been achieved.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative. This alternative utilizes conventional construction techniques and equipment to remove contaminated sediment.
Reliability of the Technology	Excavation is a commonly utilized construction technique/process that is very reliable. It is very unlikely that a technical problem would lead to schedule delays.
Ease of Undertaking Additional Remedial Actions, if Necessary	It is unlikely that future additional remedial actions would be necessary since excavation with confirmatory sediment sampling would ensure that all contaminated sediment is removed from the site. If future remedial actions were deemed necessary, the performance of this alternative would not have any impact on the future implementation of additional actions.
Ability to Monitor Effectiveness of Remedy	The effectiveness of this alternative would be monitored during excavation through the use of excavation bottom and sidewall samples to confirm that no sediment remains at the site with concentrations of arsenic that might constitute a human health risk. No sediment monitoring would be necessary after completion of the remedy and no potential migration or exposure pathways would need to be monitored.

TABLE 4-21D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE NS-4
REMOVAL AND OFF-SITE DISPOSAL – NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this altenative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Off-site disposal facilities would be available to handle the anticipated volume of sediment that would be excavated and transported for off-site disposal under this alternative. Dewatering effluent will be treated and discharged on-site.
Availability of Necessary Equipment and Specialists	This alternative uses conventional construction equipment to accomplish sediment removal. Equipment, and skilled labor required to perform the alternative would be readily available from several sources.
Availability of Prospective Technologies	Excavation and off-site disposal of contaminated sediment is a commonly used remedial option that is proven and reliable.
7. Cost	
Capital Costs	$2,997,000
Operations and Maintenance Costs	$95,000/year 1-3 only
Present Worth Costs	$3,247,000

TABLE 4-22A
ALTERNATIVE DS-1 (NO ACTION)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR may not be attained within the meaning of the statute since contaminated sediments that are left in place may provide a source of contaminants to surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR may not be attained within the meaning of the statute since contaminated sediments that are left in place may provide a source of contaminants to surface water.

TABLE 4-22B
ALTERNATIVE DS-1 (NO ACTION)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative DS-1.	No action would be taken under Alternative DS-1 that would invoke a location-specific ARAR.

TABLE 4-22C
ALTERNATIVE DS-1 (NO ACTION)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria [Clean Water Act-Section 304(a)(1)]	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR may not be attained since contaminated sediments that are left in place may provide a source of contaminants to surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	This ARAR may not be attained since contaminated sediments that are left in place may provide a source of contaminants to surface water.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.

TABLE 4-22D
DETAILED ANALYSIS OF ALTERNATIVE DS-1
NO ACTION – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures by dredging workers to arsenic in deep sediment located within the Halls Brook Holding Area and Wells G&H Wetland. Because this alternative does not take action to mitigate these risks, this alternative does not provide any protection to human health.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to deep sediment within the Halls Brook Holding Area or Wells G&H Wetland. Therefore, despite the fact that no actions would be taken under this alternative, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with the chemical-specific ARARs identified on Table 4-22C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	This alternative would not comply with the action-specific ARARs identified on Table 4-22A.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for deep sediment that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate potential future exposures to deep sediment located at in portions of the Halls Brook Holding Area and Wells G&H Wetland. All of the potential risks associated with exposure to contaminants in deep sediments would remain. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken under this alternative, no provisions would be taken to control future exposures to deep sediment. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.

TABLE 4-22D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-1
NO ACTION – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for deep sediment in the Halls Brook Holding Area and Wells G&H Wetland would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in deep sediment in the Halls Brook Holding Area and Wells G&H Wetland.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.

TABLE 4-22D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-1
NO ACTION – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-23A
ALTERNATIVE DS-2 (INSTITUTIONAL CONTROLS)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.

TABLE 4-23B
ALTERNATIVE DS-2 (INSTITUTIONAL CONTROLS)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Alternative DS-2.	There are no actions that would be performed that would invoke a location-specific ARAR.

TABLE 4-23C
ALTERNATIVE DS-2 (INSTITUTIONAL CONTROLS)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-23D
DETAILED ANALYSIS OF ALTERNATIVE DS-2
INSTITUTIONAL CONTROLS – DEEP SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures by dredging workers to arsenic in deep sediment located in certain portions of the Halls Brook Holding Area and the Wells G&H Wetland. This alternative would utilize institutional controls such as deed restrictions and local ordinances to restrict or regulate future on-site activities (dredging) that would create exposures to contaminated deep sediment areas. The types of restrictions that would be implemented might include requirements for health and safety precautions (personal protective equipment) in the event that dredging is performed in these areas. The overall protection of human health that would be provided by this alternative would be limited by the extent to which these restrictions can be enforced.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to deep sediment within the Halls Brook Holding Area and the Wells G&H Wetland. Therefore, despite the fact that no actions would be taken under this alternative to reduce ecological risks, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with the chemical-specific ARARs identified on Table 4-23C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	This alternative would not comply with the action-specific ARARs identified on Table 4-23A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for deep sediment that were established based on human health risk assessment guidance, so long as institutional controls are adequately enforced.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the implementation of this alternative would be low since the likelihood that institutional controls would be an effective deterrent to human exposures to deep sediment is high. Human exposure to contaminated deep sediments would only occur under a dredging scenario. At present, contaminants in deep sediments are not readily accessible to human receptors. However, since contamination would remain on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.

TABLE 4-23D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-2
INSTITUTIONAL CONTROLS – DEEP SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
3. Long-Term Effectiveness and Permanence (cont.)	
Adequacy and Reliability of Controls	Since no technologies would be utilized under this alternative, no process efficiencies or performance standards would need to be met and no technical components would need to be replaced. Since no treatment, containment, or removal of contaminants would occur under this alternative, long-term monitoring to verify the protectiveness of the remedy would be required. Long-term monitoring would likely consist of periodic inspections for evidence of human contact with contaminated sediment in the human health risk areas, and potentially the collection of sediment samples to evaluate the progress of natural contaminant degradation. There is limited uncertainty that institutional controls could adequately control potential human exposures to contaminated deep sediment in the Halls Brook Holding Area and the Wells G&H Wetland. In order to access the deep sediments, dredging or coring equipment would need to be mobilized to the site. Deep sediments in the human health risk areas are not readily accessible to human receptors.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative does not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative.
Protection of Workers During Remedial Actions	No impacts to workers would result from the implementation of this alternative since no on-site actions that involve potential contact with contaminated sediment would be conducted.
Environmental Impacts	No impacts to the environment would result from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	Protection against potential future exposures to deep sediment that would be provided by the imposition of institutional controls would be achieved as soon as the appropriate legal agreements can be drafted and approved. To the extent that these controls or restrictions can be effectively enforced, this would achieve the remedial action objectives for deep sediment.

TABLE 4-23D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-2
INSTITUTIONAL CONTROLS – DEEP SEDIMENT
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Future remedial actions might be necessary if institutional controls do not prove to be an effective deterrent to the types of activities that would cause unacceptable exposures to contaminated deep sediment in the Halls Brook Holding Area and the Wells G&H Wetland. Additional remedial actions could easily be taken if necessary.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in sediment. No migration or exposure pathways exist that cannot by monitored adequately.
Ability to Obtain Approvals from Other Agencies	No approvals from other agencies would be required for this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alteranative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$44,000
Operations and Maintenance Costs	$30,000
Present Worth Costs	$459,000

TABLE 4-24A
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained because (a) there is no practical alternative method that would achieve the cleanup objective with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criterion to determine whether they should be managed as hazardous waste.
	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J	Applicable		Will be attained. Any contaminated materials or contaminated equipment would be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations would also be complied with for any off-site disposal.

TABLE 4-24A (cont.)
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative DS-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.
	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative DS-3 will comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that DS-3 would comply with applicable standards.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through BMPs; (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.
	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.

TABLE 4-24A (cont.)
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.
	Mass. Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Applicable	Section 30.300 identifies the requirements for disposal of hazardous waste; Sections 30.680 and 30.690 identify requirements for long-term storage of RCRA hazardous waste in containers and tank systems similar to federal RCRA storage requirements identified above. Section 30.340 allows on-site accumulation of hazardous waste for up to 90 days and is also similar to federal RCRA storage requirements identified above.	See discussion of federal RCRA Hazardous Waste Regulations above.

TABLE 4-24B
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative DS-3 would not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities 40 CFR 264.18(b)	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative DS-3 would not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative DS-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.

TABLE 4-24B (cont.)
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS
PAGE 2 OF 2

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

TABLE 4-24C
ALTERNATIVE DS-3 (REMOVAL AND OFF-SITE DISPOSAL)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	DS-3 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that DS-3 would comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. For protection of freshwater aquatic life due to chronic exposure: Arsenic Criteria: 190 ug/L Benzene: 46 ug/L	AWQC for arsenic and other site-related constituents will be attained once the source of contaminated groundwater discharges is eliminated.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based PRGs developed for this Site. The PRGs are below the UCLs.

TABLE 4-24D
DETAILED ANALYSIS OF ALTERNATIVE DS-3
REMOVAL AND OFF-SITE DISPOSAL – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment indicate that there is unacceptable potential risk to human health resulting from future exposures by dredging workers to arsenic in deep sediment located in certain portions of the Halls Brook Holding Area and the Wells G&H Wetland. This alternative would eliminate these human health risks by removing sediment from all of the sediment core locations that are located in the human health risk areas delineated on Figure 2-5d and replacing it with clean material. The overall protection of human health that would be provided by this alternative would be high, since contaminated sediments that present potential future human health risks would be removed from the Site.
Environmental Protection	The results of the baseline ecological risk assessment did not identify unacceptable risks to ecological receptors from exposure to sediment within the sediment core sample locations. Therefore, no unacceptable ecological risks would result from the implementation of this alternative.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would comply with the pertinent chemical-specific ARARs listed in Table 4-24C.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs listed in Table 4-24B.
Action-Specific ARARs	This alternative would comply with the pertinent action-specific ARARs listed in Table 4-24A.
Other Criteria, Advisories, and Guidance	This alternative would comply with the PRGs for deep sediment that were established based on human health risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	There would be no residual risk after implementation of this alternative since all of the sediment that was determined to present potential future human health would be removed from the Site and transported for disposal at an off-site landfill facility. Since no contamination would remain on-site above PRGs, five-year reviews would not be required to periodically evaluate risks associated with sediment core locations.
Adequacy and Reliability of Controls	Since no sediment with concentrations of contaminants exceeding remediation goals would be left on Site after implementation of this alternative, no operations and maintenance would be required and there would be no controls upon which the protectiveness of the remedy would rely.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	Dewatering effluent that is generated from the pre-treatment process that would be performed prior to transportation and off-site disposal of sediment would be treated to remove contaminants. No treatment would be performed on sediments under this alternative.

TABLE 4-24D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-3
REMOVAL AND OFF-SITE DISPOSAL – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Amount of Hazardous Materials Destroyed or Treated	Based on the anticipated volume of sediment that would be removed under this alternative and assumed water content of approximately 50%, approximately 150,000,000 gallons of water would be generated from dewatering activities. All of this water would need to be treated prior to discharge back to the environment. No treatment would be performed on sediment under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	Dewatering effluent would be treated to levels that allow discharge back to the environment. No treatment of sediment would be performed under this alternative.
Degree to Which Treatment is Irreversible	Treatment of water that would be performed under this alternative would be irreversible. Contaminants would be permanently removed from dewatering effluent. No treatment of sediment would be performed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	Treatment residuals from the treatment of dewatering effluent would consist of used sand filter medium that would be regenerated or disposed of at an off-site facility. No treatment of sediment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	There would be no health impacts to the community associated with the implementation of this alternative. The spread of contamination beyond the exclusion zone (excavation areas) would be prevented through the use of personnel and equipment decontamination and other engineering controls (erosion and sedimentation controls, etc.) designed to prevent unintended transport of contaminated sediment. Community risks resulting from an increase in truck traffic that would result from the transportation and disposal of such a large volume of material would be mitigated through the development of traffic control plans, but disruptions to the community are inevitable.
Protection of Workers During Remedial Actions	Potential impacts to workers during sediment removal would be mitigated through the use of adequate health and safety procedures, including personal protective equipment and decontamination facilities.
Environmental Impacts	Impacts to the environment from monitoring activities that would be conducted under this alternative would be significant, since extensive excavation would be performed in a floodplain/wetland area and surface water flow would be diverted for a period of time during sediment removal.
Time Until Remedial Action Objectives are Achieved	The time frame for the completion of sediment removal would be approximately 5 years, after which time the remedial action objectives will have been achieved.

TABLE 4-24D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE DS-3
REMOVAL AND OFF-SITE DISPOSAL – DEEP SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability	
Ability to Construct and Operate the Technology	There is considerable uncertainty as to the ability to divert surface water flow and dewater excavation areas that cover such a large area.
Reliability of the Technology	Mechanical excavation would be used to remove sediment from the sediment core areas. Excavation is a well-developed and conventional technology that is reliable for the removal of contaminated sediment. However, in order to excavate to the depth required to achieve RAOs, an extensive dewatering system would need to be designed and operated to divert surface water flow around the excavation areas. While this approach is technically feasible, the reliability of this approach would be questionable. Delays related to technical problems associated with the dewatering system are likely to be encountered.
Ease of Undertaking Additional Remedial Actions, if Necessary	It is not likely that additional remedial actions would be needed after implementation of this alternative since all sediment with contaminants exceeding remediation goals would be removed from the Site. However, the implementation of this alternative would have no bearing on the performance of remedial actions that might be taken in the future, should they be required.
Ability to Monitor Effectiveness of Remedy	The effectiveness of the remedy would be monitored during implementation through the collection of cleanup confirmation samples in the excavated areas to confirm that all sediment with contaminants in excess of remediation goals are removed from the river channel in the targeted areas.
Ability to Obtain Approvals from Other Agencies	Approvals from other agencies would not be required to implement this alternative.
Coordination with Other Agencies	Coordination with other agencies would not be required to implement this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Due to the large volume of sediment that would need to be removed to implement this alternative (approximately 160,000 cubic yards in-situ), the availability of off-site disposal facilities with the capacity to accept material from the Site would be limited.
Availability of Necessary Equipment and Specialists	No specialized equipment or technical specialists would be required for this alternative.
Availability of Prospective Technologies	This alternative would involve conventional technologies that are readily available.
7. Cost	
Capital Costs	$116,968,000
Operations and Maintenance Costs	$100,000/year for years 1 through 5
Present Worth Costs	$117,378,000

TABLE 4-25A
ALTERNATIVE SW-1 (NO ACTION)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.

TABLE 4-25B
ALTERNATIVE SW-1 (NO ACTION)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs for Alternative SW-1.	No action will be taken under Alternative SW-1 that will invoke a location-specific ARAR.

TABLE 4-25C
ALTERNATIVE SW-1 (NO ACTION)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-25D
DETAILED ANALYSIS OF ALTERNATIVE SW-1
NO ACTION – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from surface water in the HBHA Pond. Therefore, despite the fact that this alternative takes no action to contain, remove, or treat contamination, no unacceptable human health risks would result from the implementation of this alternative.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to arsenic and benzene in deep surface water. Since this alternative takes no action to contain, remove, or treat contaminated surface water in the pond, unacceptable risks to ecological receptors would remain.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs presented on Table 4-25C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	This alternative would not comply with action-specific ARARs presented on Table 4-25A.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for surface water that were established based on ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate ecological exposures to HBHA Pond surface water. The source of this risk would be the deep surface water at the sediment/surface water interface located at the bottom of the Pond in the area of groundwater discharge. Since contamination would remain above levels that allow for unrestricted exposure, five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken to contain, remove, or treat surface water in the HBHA Pond under this alternative, no provisions would be taken to control ecological exposures. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative would not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to biological and geochemical activity.

TABLE 4-25D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-1
NO ACTION – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from this alternative since no actions would be taken.
Protection of Workers During Remedial Actions	No impacts to workers would result from this alternative since no actions would be taken.
Environmental Impacts	No impacts to the environment would result from this alternative since no actions would be taken.
Time Until Remedial Action Objectives are Achieved	Since no actions would be taken to address contamination that is the cause of unacceptable risks, remedial actions objectives for surface water would not be achieved in the reasonably foreseeable future
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in surface water at the bottom of the HBHA Pond.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or technical specialists would be required for this alternative.

TABLE 4-25D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-1
NO ACTION – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$0
Present Worth Costs	$0

TABLE 4-26A
ALTERNATIVE SW-2 (MONITORING) ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.

TABLE 4-26B
ALTERNATIVE SW-2 (MONITORING) LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Alternative SW-2 (Monitoring).	There are no actions that would be performed that would invoke a location-specific ARAR.

TABLE 4-26C
ALTERNATIVE SW-2 (MONITORING) CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-26D
DETAILED ANALYSIS OF ALTERNATIVE SW-2
MONITORING – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from surface water in the HBHA Pond. Therefore, despite the fact that this alternative takes no action to contain, remove, or treat contamination, no unacceptable human health risks would result from the implementation of this alternative.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to arsenic and benzene in deep surface water. Since this alternative takes no action to contain, remove, or treat contaminated surface water in the pond, unacceptable risks to ecological receptors will remain. Monitoring will be conducted to evaluate potential natural degradation of contaminants and potential reductions in contamination from the groundwater source.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs presented on Table 4-25C.
Location-Specific ARARs	Since there are no actions associated with this alternative, there are no location-specific ARARs identified.
Action-Specific ARARs	This alternative would not comply with action-specific ARARs presented on Table 4-25A.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for surface water that were established based on ecological risk assessment guidance.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate ecological exposures to HBHA Pond surface water. The source of this risk would be the deep surface water at the sediment/surface water located at the bottom of the Pond in the area of groundwater discharge. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken to contain, remove, or treat surface water in the HBHA Pond under this alternative, no provisions would be taken to control ecological exposures. No technologies would be utilized, therefore no operations and maintenance would be required.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative would not employ a treatment process.
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.

TABLE 4-26D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-2
MONITORING – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions (other than the collection of environmental samples) would be taken.
Protection of Workers During Remedial Actions	Potential impacts to workers during surface water, sediment, and groundwater monitoring could be mitigated through the use of adequate health and safety procedures, including personal protective equipment and decontamination facilities.
Environmental Impacts	Impacts to the environment from the monitoring activities that would be conducted under this alternative would be minimal.
Time Until Remedial Action Objectives are Achieved	If no groundwater treatment is conducted upgradient from the HBHA Pond, the time frame for the achievement of remedial objectives would be very long. Treatment of groundwater that discharges to the Pond may reduce the time frame for recovery, but not to within an acceptable time frame.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative since no actions would be taken.
Reliability of the Technology	No treatment technologies would be employed under this alternative.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring would be used to evaluate the degree of natural degradation that is occurring in surface water and groundwater.
Ability to Obtain Approvals from Other Agencies	Because this alternative does not require any activities, no approvals would be required.
Coordination with Other Agencies	Because this alternative does not require any activities, no coordination with other agencies would be required.

TABLE 4-26D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-2
MONITORING – SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	The equipment and technical specialists that would be required to monitor and evaluate monitoring data for this alternative would be readily available.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$0
Operations and Maintenance Costs	$236,000/year
Present Worth Costs	$3,226,000

TABLE 4-27A
ALTERNATIVE SW-3 (MONITORING AND PROVIDE ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative SW-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained in part because (a) there is no practical alternative that would achieve remedial objectives with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved.
	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.

TABLE 4-27A (cont.)
ALTERNATIVE SW-3 (MONITORING AND PROVIDE ALTERNATE HABITAT)
ACTION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.

TABLE 4-27B
ALTERNATIVE SW-3 (MONITORING AND PROVIDE ALTERNATE HABITAT)
LOCATION-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will not be attained. There is no practicable alternative to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative SW-3 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.

TABLE 4-27C
ALTERNATIVE SW-3 (MONITORING AND PROVIDE AN ALTERNATE HABITAT)
CHEMICAL-SPECIFIC ARARs
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR would not be attained unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop PRGs.

TABLE 4-27D
DETAILED ANALYSIS OF ALTERNATIVE SW-3
MONITORING AND PROVIDING ALTERNATE HABITAT – DEEP SURFACE WATER IN THE HBHA POND
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
1. Overall Protection of Human Health and the Environment	
Human Health Protection	The results of the baseline human health risk assessment did not identify unacceptable human health risk from deep surface water in the HBHA Pond. Therefore, despite the fact that this alternative takes no action to contain, remove, or treat contamination, no unacceptable human health risks would result from the implementation of this alternative.
Environmental Protection	The results of the baseline ecological risk assessment indicated unacceptable ecological risks to benthic communities in the HBHA Pond due to exposure to arsenic and benzene in deep surface water. Since this alternative takes no action to contain, remove, or treat contaminated surface water in the pond, unacceptable risks to ecological receptors will remain. Monitoring will be conducted to evaluate potential natural degradation of contaminants and potential reductions in contamination from the groundwater source. An alternate habitat would be constructed to compensate for loss of habitat to the benthic invertebrates and to maintain the benthic invertebrate inventory within the watershed.
2. Compliance with ARARs	
Chemical-Specific ARARs	This alternative would not comply with chemical-specific ARARs.
Location-Specific ARARs	This alternative would comply with the pertinent location-specific ARARs that are presented on Table 4-27B.
Action-Specific ARARs	This alternative would comply with all of the pertinent action-specific ARARs that are presented on Table 4-27A except for federal and state water quality criteria regulations.
Other Criteria, Advisories, and Guidance	This alternative would not comply with the PRGs for surface water that were established based on ecological risk assessment guidance, but would comply with the RAO by providing an alternate habitat.
3. Long-Term Effectiveness and Permanence	
Magnitude of Residual Risk	The magnitude of residual risk that would result from the selection of this alternative would be high since no actions would be taken to mitigate ecological exposures to HBHA Pond surface water. The source of this risk would be the deep surface water at the sediment/surface water located at the bottom of the Pond in the area of groundwater discharge. Five-year reviews would be required to periodically evaluate risks associated with on-site contamination.
Adequacy and Reliability of Controls	Since no actions would be taken to contain, remove, or treat surface water in the HBHA Pond under this alternative, no provisions would be taken to control ecological exposures. No technologies would be utilizied, therefore no operations and maintenance would be required. Long-term effectiveness of the compensatory wetlands would require periodic maintenance to ensure that the vegetation and biota are established.
4. Reduction of Toxicity, Mobility, and Volume Through Treatment	
Treatment Process Used and Materials Treated	This alternative would not employ a treatment process.

TABLE 4-27D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-3
MONITORING AND PROVIDING ALTERNATE HABITAT – DEEP SURFACE WATER IN THE HBHA POND
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
4. Reduction of Toxicity, Mobility, and Volume Through Treatment (cont.)	
Amount of Hazardous Materials Destroyed or Treated	No hazardous materials would be destroyed or treated under this alternative.
Degree of Expected Reductions in Toxicity, Mobility, and Volume	There would be no reduction in the toxicity, mobility, and volume of contaminants under this alternative beyond that which would occur naturally due to subsurface geochemical activity.
Degree to Which Treatment is Irreversible	No treatment would be employed under this alternative.
Type and Quantity of Residuals Remaining After Treatment	No treatment would be employed under this alternative.
5. Short-Term Effectiveness	
Protection of Community During Remedial Actions	No impacts to the community would result from the implementation of this alternative since no on-site actions (other than the collection of environmental samples) would be taken. Impacts from the siting and construction of the compensatory wetland would be considered minor depending on the location and the steps required to acquire a suitable property.
Protection of Workers During Remedial Actions	Potential impacts to workers during surface water, sediment, and groundwater monitoring could be mitigated through the use of adequate health and safety procedures, including personal protective equipment and decontamination facilities. No impacts are anticipated due to construction of the compensatory wetland.
Environmental Impacts	Impacts to the environment from the monitoring activities that would be conducted under this alternative would be minimal. Construction of the compensatory wetland would be a positive impact to the environment.
Time Until Remedial Action Objectives are Achieved	If no groundwater treatment is conducted upgradient from the HBHA Pond, the time frame for the achievement of remedial objectives in the Pond would be very long. Treatment of groundwater that discharges to the Pond may reduce the time frame for recovery, but not to within an acceptable time frame. Since RAOs are not likely to be achieved in the Pond through a decrease in contaminant concentrations, the achievement of RAOs by this alternative would be occur once compensatory wetland has been constructed and shown to be established. Establishment of the compensatory wetland may take up to 5 years.
6. Implementability	
Ability to Construct and Operate the Technology	No construction difficulties or uncertainties would be encountered under this alternative. Few uncertainties are associated with the construction of the compensatory wetland.
Reliability of the Technology	No treatment technologies would be employed under this alternative.

TABLE 4-27D (cont.)
DETAILED ANALYSIS OF ALTERNATIVE SW-3
MONITORING AND PROVIDING ALTERNATE HABITAT – DEEP SURFACE WATER IN THE HBHA POND
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

EVALUATION CRITERIA	DETAILED ANALYSIS
6. Implementability (cont.)	
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions could be taken if necessary, but none would be taken under this alternative.
Ability to Monitor Effectiveness of Remedy	Monitoring could be used to evaluate the degree of natural degradation that is occurring in groundwater.
Ability to Obtain Approvals from Other Agencies	MEDEP, US Army Corps of Engineers, and local conservation commission approvals may be required to site, design, and construct the compensatory wetland.
Coordination with Other Agencies	Coordination with state, federal and local agencies would be required to construct the wetland.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, and disposal would be required under this alternative.
Availability of Necessary Equipment and Specialists	No specialized equipment is required for this alternative. Technical wetland specialists would be required to design the compensatory wetland.
Availability of Prospective Technologies	No technologies are required for this alternative.
7. Cost	
Capital Costs	$7,807,000
Operations and Maintenance Costs	$236,000
Present Worth Costs	$10,797,000

TABLE 4-28A
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE SOILS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SS-1: No Action	Alternative SS-2: Monitoring with Institutional Controls	Alternative SS-3: Permeable Cover and Monitoring with Institutional Controls	Alternative SS-4: Excavation and Off-Site Disposal	Alternative SS-5: Excavation, Treatment, and On-Site Reuse
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	☐	◘	■	■	■
Ecological Protection	NA	NA	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	NA	NA	NA	NA	NA
Location-Specific ARARs	NA	■	■	■	■
Action-Specific ARARs	NA	■	■	■	■
Other Criteria, Advisories, Guidance	☐	■	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	☐	■	■	■	■
Magnitude of Residual Risk - Ecological:	■	■	■	■	■
Adequacy and Reliability of Controls	☐	◘	◘	■	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible				
Treatment/Recycling Processes Utilized	☐	☐	☐	☐	■
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	☐	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	☐	■
Irreversibility	☐	☐	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	■	■	■	■	■
Environmental Impacts	■	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	☐	■	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	☐	☐	☐
Reliability of the Technology	☐	☐	◘	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐	■	■
Ability to Monitor Effectiveness of the Remedy	☐	◘	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	■	☐
Availability of Prospective Technologies	■	■	■	■	☐
COST					
Capital	$0	$185,000	$5,329,000	$47,172,000	$22,993,000
O&M	$0	$30,000/yr	$48,000/yr	$0	$0
Present Worth	$0	$600,000	$5,992,000	$47,172,000	$22,993,000

TABLE 4-28B
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SUBSURFACE SOILS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SUB-1: No Action	Alternative SUB-2: Monitoring with Institutional Controls	Alternative SUB-3: Permeable Cover and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	☐	■	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	NA	NA	NA
Location-Specific ARARs	NA	■	■
Action-Specific ARARs	NA	■	■
Other Criteria, Advisories, Guidance	☐	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	☐	■	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	☐	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	☐
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐
Irreversibility	☐	☐	☐
Type and Quantity of [Process] Residuals	☐	☐	☐
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	☐
Time Until Remedial Action Objectives are Achieved	☐	■	◘
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	☐
Reliability of the Technology	☐	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐
Ability to Monitor Effectiveness of the Remedy	☐	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$315,000	$6,495,000
O&M	$0	$108,000 (Years 1-10) $30,000 (Years 11-30)	$159,000 (Years 1-10) $81,000 (Years 11-30)
Present Worth	$0	$1,276,000	$8,070,000

TABLE 4-28C
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR GROUNDWATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative GW-1: No Action	Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	☐	◘	■	■
Ecological Protection	☐	☐	■	■
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	NA	◘	■	■
Location-Specific ARARs	NA	■	■	■
Action-Specific ARARs	NA	■	■	■
Other Criteria, Advisories, Guidance	☐	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	☐	◘	◘	◘
Magnitude of Residual Risk - Ecological:	☐	◘	■	■
Adequacy and Reliability of Controls	☐	◘	■	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible			
Treatment/Recycling Processes Utilized	☐	◘	■	■
Amount of Hazardous Materials Destroyed or Treated	☐	◘	■	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	◘	■	■
Irreversibility	☐	◘	■	◘
Type and Quantity of [Process] Residuals	☐	◘	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	☐	◘	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	☐	☐
Reliability of the Technology	☐	■	■	☐
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘	☐
Ability to Monitor Effectiveness of the Remedy	☐	■	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	☐
Availability of Prospective Technologies	■	■	■	☐
COST				
Capital	$0	$432,000	$4,739,000	$13,089,000
O&M	$0	$410,000 (yr 1-5) $205,500 (yr 6-30)	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$444,000 (yr 1-5) $222,000 (yr 6-30)
Present Worth	$0	$3,918,000	$19,137,000	$17,792,000

TABLE 4-28D
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR HBHA POND SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative HBHA-1: No Action	Alternative HBHA-2: Monitoring	Alternative HBHA-3: Subaqueous Cap	Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing Alternate Habitat	Alternative HBHA-5: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	☐	☐	◘	■	■
Ecological Protection	☐	☐	◘	■	■
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	☐	☐	■	◘	■
Location-Specific ARARs	NA	NA	■	■	■
Action-Specific ARARs	NA	NA	■	■	■
Other Criteria, Advisories, Guidance	☐	☐	■	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	☐	☐	■	■	■
Magnitude of Residual Risk - Ecological:	☐	☐	◘	◘	■
Adequacy and Reliability of Controls	☐	☐	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible				
Treatment/Recycling Processes Utilized	☐	☐	☐	◘	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	◘	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	◘	◘
Irreversibility	☐	☐	☐	■	■
Type and Quantity of [Process] Residuals	☐	☐	☐	◘	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	☐	■	■	■	■
Environmental Impacts	■	◘	☐	☐	☐
Time Until Remedial Action Objectives are Achieved	☐	☐	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	☐	◘	◘
Reliability of the Technology	☐	☐	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐	◘	■
Ability to Monitor Effectiveness of the Remedy	☐	■	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	☐	◘	◘
Availability of Prospective Technologies	■	■	☐	■	■
COST					
Capital	$0	$0	$3,160,000	$4,833,000	$3,560,000
O&M	$0	$144,000/yr 1-2 $70,000 yr 3-30	$144,000/yr	$144,000/yr $1,136,500 (every 5 yrs)	$95,000/yrs 1-3 only
Present Worth	$0	$1,201,000	$5,291,000	$8,237,000	$3,810,000

NOTE: The effectiveness of HBHA-2, HBHA-3, and HBHA-5 assume that contaminated groundwater discharges to the HBHA Pond will be eliminated. This assumption is not necessary for HBHA-4.

TABLE 4-28E
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR NEAR-SHORE SEDIMENTS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative NS-1: No Action	Alternative NS-2: Institutional Controls	Alternative NS-3: Monitoring with Institutional Controls	Alternative NS-4: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	☐	◘	◘	■
Ecological Protection	NA	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	☐	☐	☐	■
Location-Specific ARARs	NA	NA	NA	■
Action-Specific ARARs	☐	☐	☐	■
Other Criteria, Advisories, Guidance	☐	◘	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	☐	◘	◘	■
Magnitude of Residual Risk - Ecological:	☐	■	■	■
Adequacy and Reliability of Controls	☐	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible			
Treatment/Recycling Processes Utilized	☐	☐	☐	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	◘
Irreversibility	☐	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	■	■	◘
Time Until Remedial Action Objectives are Achieved	☐	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	■	◘
Reliability of the Technology	☐	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	◘	■	■	■
Ability to Monitor Effectiveness of the Remedy	☐	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	◘
Availability of Prospective Technologies	■	■	■	■
COST				
Capital	$0	$70,000	$70,000	$2,997,000
O&M	$0	$16,000 /yr	$135,000 /yr	$95,000 yrs 1-3 only
Present Worth	$0	$338,000	$1,807,000	$3,247,000

☐ **Low rating in comparison to other alternatives for specified criterion**

◘ **Mid-range rating in comparison to other alternatives for specified criterion**

■ **High rating in comparison to other alternatives for specified criterion**

TABLE 4-28F
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR DEEP SEDIMENTS CORES LOCATIONS
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative DS-1: No Action	Alternative DS-2: Institutional Controls	Alternative DS-3: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	☐	◘	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	☐	☐	■
Location-Specific ARARs	NA	NA	■
Action-Specific ARARs	☐	☐	■
Other Criteria, Advisories, Guidance	☐	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	☐	☐	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	☐	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	◘
Irreversibility	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	◘
Environmental Impacts	■	■	☐
Time Until Remedial Action Objectives are Achieved	■	■	☐
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	◘	☐
Reliability of the Technology	☐	◘	☐
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	■
Ability to Monitor Effectiveness of the Remedy	☐	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	◘
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	◘
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	◘
COST			
Capital	$0	$44,000	$116,968,000
O&M	$0	$30,000 /yr	$100,000 yrs 1-3 only
Present Worth	$0	$459,000	$117,378,000

TABLE 4-28G
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE WATER
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SW-1: No Action	Alternative SW-2: Monitoring	Alternative SW-3: Monitoring and Providing an Alternate Habitat
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	NA	NA	NA
Ecological Protection	☐	☐	◘
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	☐	☐	☐
Location-Specific ARARs	■	■	■
Action-Specific ARARs	■	■	◘
Other Criteria, Advisories, Guidance	☐	☐	◘
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	■	■	■
Magnitude of Residual Risk - Ecological:	☐	☐	◘
Adequacy and Reliability of Controls	☐	☐	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	☐
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐
Irreversibility	☐	☐	☐
Type and Quantity of [Process] Residuals	☐	☐	☐
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	◘
Time Until Remedial Action Objectives are Achieved	☐	☐	◘
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	◘
Reliability of the Technology	☐	■	◘
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘
Ability to Monitor Effectiveness of the Remedy	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$0	$7,807,000
O&M	$0	$236,000 /yr	$236,000 /yr
Present Worth	$0	$3,226,000	$10,797,000

TABLE 4-29
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
DRAFT FINAL MSGRP FEASIBILITY STUDY
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	COSTS		
							Capital Costs	Annual O&M Costs	Present Worth
SURFACE SOIL (SS)									
Alternative SS-1: No Action	□	□	□	□	■	■	$0	$0	$0
Alternative SS-2: Institutional Controls	◘	■	◘	□	■	■	$185,000	$30,000	$600,000
Alternative SS-3: Permeable Cover with Institutional Controls	■	■	◘	□	◘	◘	$5,329,000	$48,000	$5,992,000
Alternative SS-4: Excavation and Off-Site Disposal	■	■	■	□	◘	■	$47,172,000	$0	$47,172,000
Alternative SS-5: Excavation, Treatment, and On-Site Reuse	■	■	■	■	◘	◘	$22,993,000	$0	$22,993,000
SUBSURFACE SOIL (SUB)									
Alternative SUB-1: No Action	□	□	□	□	◘	■	$0	$0	$0
Alternative SUB-2: Institutional Controls	■	■	◘	□	■	■	$315,000	$108,000 (yr 1-10) $30,000 (yr 11-30)	$1,276,000
Alternative SUB-3: Permeable Cover with Institutional Controls	■	■	■	□	◘	◘	$6,495,000	$159,000 (yr 1-10) $81,000 (yr 11-30)	$8,070,000
GROUNDWATER (GW)									
Alternative GW-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	◘	■	◘	◘	◘	■	$432,000	$410,000 (yr 1-5) $205,500 (yr 6-30)	$3,918,000
Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	■	■	■	■	◘	◘	$4,739,000	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$19,137,000
Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment, and Monitoring with Institutional Controls	■	■	◘	◘	◘	□	$13,089,000	$444,000 (yr 1-5) $222,000 (yr 6-30)	$17,792,000
HBHA POND SEDIMENTS (HBHA)									
Alternative HBHA-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative HBHA-2: Monitoring	□	□	□	□	◘	■	$0	$144,000/yr 1-2 $70,000/yr 3-30	$1,201,000
Alternative HBHA-3: Subaqueous Cap	■	■	◘	□	◘	□	$3,160,000	$144,000	$5,291,000
Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat	■	◘	◘	◘	◘	◘	$5,419,000	$176,000/yr 1-3 $100,000/yr 4-30 $1,136,500 (every 5yrs)	$9,187,000
Alternative HBHA-5: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$3,560,000	$95,000/yr 1-3 only	$3,810,000
NEAR SHORE SEDIMENTS (NS)									
Alternative NS-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative NS-2: Institutional Controls	◘	◘	◘	□	■	■	$70,000	$16,300	$338,000
Alternative NS-3: Monitored Natural Recovery	◘	◘	◘	□	■	■	$70,000	$135,000	$1,807,000
Alternative NS-4: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$2,997,000	$95,000/yr 1-3 only	$3,247,000
DEEP SEDIMENTS (DS)									
Alternative DS-1: No Action	□	□	□	□	■	◘	$0	$0	$0
Alternative DS-2: Institutional Controls	◘	◘	◘	□	■	■	$44,000	$30,000	$459,000
Alternative DS-3: Removal and Off-Dite Disposal	■	■	■	◘	□	◘	$116,968,000	$100,000/yr 1-3 only	$117,378,000
SURFACE WATER (SW)									
Alternative SW-1: No Action	□	◘	□	□	■	◘	$0	$0	$0
Alternative SW-2: Monitoring	□	◘	◘	□	■	■	$0	$236,000	$3,226,000
Alternative SW-3: Monitoring and Providing an Alternate Habitat	◘	◘	■	□	■	◘	$7,807,000	$236,000	$10,797,000

□ **Low rating in comparison to other alternatives for specificed criterion**

◘ **Mid-range rating in comparison to other alternatives for specificed criterion**

■ **High rating in comparison to other alternatives for specified criterion**